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1. SPECIAL FEATURES

These ABS instructions can be used for testing all Mercedes-Benz vehicles of type W 124 (as of 1.85). Further details can be found in the similar, detailed SIS instructions MB 500 (type W 201).

2. TEST SPECIFICATIONS

For reasons of safety, the ABS may only be tested using the ABS tester.

The rapid diagnosis chart contains all important test specifications as well as notes on testing and troubleshooting.

3. TEST CONDITIONS FOR TESTING WITH ABS TESTER

- The tester must have been converted to the latest technical status (identification "U2" on nameplate or as of FD 352).
- Check ground connections of return pump and overvoltage protection relay term. 31 for security and corrosion.
- Check hydraulic connections and joints on hydraulic modulator for leaks (visual examination).
- If the ABS warning lamp comes on occasionally while driving (e.g. after switching on electrical devices) and goes out again by itself, check battery and power supply (alternator, regulator and voltage drops).
- If the ABS warning lamp is constantly on and does not go out, check the following points:



- Is multiple plug correctly seated on control unit and is it latched in?
All plug contacts O.K.?
Spring contacts latched?
 - V-belt broken? (Alternator not supplying any voltage, charge indicator and ABS warning lamps on)
 - Voltage from alternator terminal 61?
Plug-in connector and lead to ABS control unit O.K.?
 - Check for loose contacts at wheel-speed sensors with program switch in position 10.
- For testing with the tester, switch on the ignition for all program switch positions (tester works on power supply from vehicle battery).
 - Watch lamps 1 and 2 of tester for all program switch positions.

Caution:

Do not drive with the tester connected.
Whenever repairs have been carried out, repeat the entire test program.

General information on trouble-shooting

Check all leads for short circuit to ground and contact with positive leads, and also watch for worn spots and pinching.

- Connect ABS tester to control unit and ABS wiring harness.

Caution:

Disconnect and connect the control unit only with the ignition off.

The control unit is installed in the equipment space behind the battery.

Do not mix up with KE-Jetronic control unit, where applicable.

- Using ohmmeter, check unidirectional-breakdown diode in overvoltage protection relay in forward and reverse directions between terminals 30 and 31.
(Substitute test for test step 5).



4. RAPID DIAGNOSIS CHART FOR ABS TESTER

Switch on ignition for all program switch positions.

<u>Program switch position</u>	<u>Testing of</u>	<u>additional operation</u>	<u>Test specifications (Reading)</u>	<u>Cause of trouble</u>
1 ... 24	Power supply for each test step	-----	Lamp 1 (green) must be lit for each test step.	<ul style="list-style-type: none"> ● Battery insufficiently charged. Repeat test step with engine running. ● High voltage drops at terminals (e.g. ground terminal). ● Open circuit in ground connection
1	Valve relay off-position	-----	Lamp 1 (green) and lamp 3 (green) must be lit.	
2	Valve relay operation	-----	Lamp 1 (green) and lamp 3 (green) must be lit.	
3	Motor relay off-position	-----	Lamp 1 (green) and lamp 3 (green) must be lit.	
4	Motor relay operation	Press illuminated key	Lamp 1 (green) and lamp 3 (green) must be lit. Pump motor running.	<ul style="list-style-type: none"> ● Open circuit or high contact resistance in leads to motor relay. ● Motor relay defective. ● Check pump motor for continuity.

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Rapid diagnosis chart
Mercedes Benz type W 124



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Rapid diagnosis chart
Mercedes Benz type W 124



<u>Program switch position</u>	<u>Testing of</u>	<u>additional operation</u>	<u>Test specifications (Reading)</u>	<u>Cause of trouble</u>
5	As an alternative, check unidirectional- breakdown diode in overvoltage protect- ion relay in forward and reverse direct- ions with ohmmeter.			
6	Internal resistances of solenoid-operated valves in hydraulic modulator	Switch off ignition. Re-connect control unit. Switch on ignition. Press key FL Press key FR Press key RA	Lamp 1 (green) must be lit. FL: 0.7 ... 1.7 Ω FR: 0.7 ... 1.7 Ω RA: 0.7 ... 1.7 Ω	<ul style="list-style-type: none"> ● Open circuit or high contact resistance in leads to the respective valve. ● Hydraulic modulator defective.
7	Ground connection to term. 10	Press illuminated key	Lamp 1 (green) must be lit. 80 ... 300 mV	<ul style="list-style-type: none"> ● Open circuit or high contact resistance in ground lead or ground terminal.
8	Ground connection to term. 34	Press illuminated key	Lamp 1 (green) must be lit. 10 ... 250 mV	
9	Ground connection to term. 20	Press illuminated key	Lamp 1 (green) must be lit. 10 ... 250 mV	

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Rapid diagnosis chart
Mercedes Benz type W 124


A7

Rapid diagnosis chart
Mercedes Benz type W 124

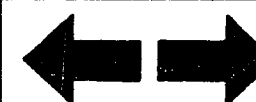


<u>Program switch position</u>	<u>Testing of</u>	<u>additional operation</u>	<u>Test specifications (Reading)</u>	<u>Cause of trouble</u>
10	Internal resistances of wheel-speed sensors	Press key FL Press key FR Press key RA	Lamp 1 (green) must be constantly lit. FL : 0.9 ... 2.3 k Ω FR : 0.9 ... 2.3 k Ω RA : 0.6 ... 1.6 k Ω Modular wheel-speed sensors as of approx. 4.85: FL : 0.6 ... 1.6 k Ω FR : 0.6 ... 1.6 k Ω	<ul style="list-style-type: none"> ● Check for loose contacts: Move all leads at fastening points, at plug and at wheel-speed sensor, and watch reading. ● Open circuit or high contact resistance in leads to the respective wheel-speed sensor. ● Respective wheel-speed sensor defective.
11	Insulation resistances of wheel-speed sensors	Press key FL Press key FR Press key RA	Lamp 1 (green) must be constantly lit. FL : 20 ... 999 k Ω FR : 20 ... 999 k Ω RA : 20 ... 999 k Ω	<ul style="list-style-type: none"> ● Check for insulation damage in leads to the respective wheel-speed sensor. ● Respective wheel-speed sensor defective.
12	DC voltage on wheel-speed sensor leads	Press key FL Press key FR Press key RA	Lamp 1 (green) must be constantly lit. FL : 000 ... 100 mV FR : 000 ... 100 mV RA : 000 ... 100 mV	<ul style="list-style-type: none"> ● Check leads to the respective wheel-speed sensor for contact (worn spot) with a positive lead. ● Respective wheel-speed sensor defective.
13	Internal control unit supply voltage	Press illuminated key	4.75 ... 5.25 V	<ul style="list-style-type: none"> ● Control unit defective

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Rapid diagnosis chart
Mercedes Benz type W 124

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Rapid diagnosis chart
Mercedes Benz type W 124


<u>Program switch position</u>	<u>Testing of</u>	<u>additional operation</u>	<u>Test specifications (Reading)</u>	<u>Cause of trouble</u>
14	Diode in forward direction and ABS warning lamp		0.4 ... 1.5 V ABS warning lamp in vehicle must be lit	<ul style="list-style-type: none"> ● Open circuit or contact resistance in leads to diode and/or warning lamp. ● Warning lamp defective. ● Diode (hydraulic modulator) defective.
15	Diode in reverse direction		1.5 ... 8.5 V ABS warning lamp slightly dimmer.	<ul style="list-style-type: none"> ● Diode (hydraulic modulator) defective.
16	Control unit BITE* triggering	Press illuminated key for 3 seconds	Warning lamp must go out after max. 1 second	<ul style="list-style-type: none"> ● Control unit defective.
17	Control unit, BITE* fault simulation	Press illuminated key for 3 seconds	Warning lamp must still be lit (flickering allowable).	<ul style="list-style-type: none"> ● Control unit defective.
18	Control unit, current for pressure holding	Press key FL, press illuminated key, press key FR, press illuminated key, press key RA press illuminated key.	FL : 1.9 ... 2.3 A FR : 1.9 ... 2.3 A RA : 1.9 ... 2.3 A	<ul style="list-style-type: none"> ● Control unit defective.
19	Control unit, current for pressure reduction	Press key FL, press illuminated key, press key FR, press illuminated key, press key RA press illuminated key.	FL : 4.5 ... 6.0 A FR : 4.5 ... 6.0 A RA : 4.5 ... 6.0 A	<ul style="list-style-type: none"> ● Control unit defective
24	Voltage from stop-lamp switch	Press brake pedal	10 ... 15 V	<ul style="list-style-type: none"> ● Lead to stop-lamp switch defective. ● Stop-lamp switch defective. ● Stop lamps defective.

* BITE = Built-in test equipment

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Rapid diagnosis chart
Mercedes Benz type W 124



A11

Rapid diagnosis chart
Mercedes Benz type W 124



A brake analyzer is required for program switch positions 20, 21, 22, and 23. Do not drive with the tester connected.
Do not use a brake-pedal actuating device for setting the braking force. Program switch position 23 must come first.

Front axle

Drive front wheels of vehicle onto brake analyzer. Pull on handbrake.

<u>Program switch position</u>	<u>Testing of</u>	<u>additional operation</u>	<u>Test specifications (Reading)</u>	<u>Cause of trouble</u>
23	Wheel-speed sensor signal and identity check	Press key FL, switch on left-hand brake roller.	<u>FL : 1.9 ... 19</u>	<ul style="list-style-type: none"> • Wheel-speed sensors mixed up? • Air gap too great. • Respective wheel-speed sensor defective.
		Press key FR, switch off left-hand brake roller, switch on right-hand brake roller.	<u>FR : 1.9 ... 19</u>	
20	Hydraulic modulator pressure reduction and identity check	Press key FR. Switch on right-hand brake roller. Press brake pedal and hold constant at 2000 N. Press illuminated key.	<u>FR : less than 1100N</u>	<ul style="list-style-type: none"> • End reading may change by max. 200 N in 3 sec. • Brake lines mixed up? • Conventional braking system O.K.? • Hydraulic modulator defective. <p><u>Note:</u> Replace hydraulic modulator only as a complete unit. Repairing is not allowed. Danger!</p>
		Press key FL. Switch off right-hand brake roller. Switch on left-hand brake roller. Press brake pedal and hold constant at 2000 N. Press illuminated key.	<u>FL : less than 1100N</u>	
21	Hydraulic modulator pressure buildup	Press key FL. Switch on both brake rollers. Press brake pedal and hold constant at 2000 N. <u>Allowable difference between both wheels max. 500 N.</u> Press illuminated key.	Left-hand brake analyzer reading moves to an intermediate value and rises again to <u>FL: 800 ... 1700 N</u>	

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Rapid diagnosis chart
Mercedes Benz type W 124



A13

Rapid diagnosis chart
Mercedes Benz type W 124



<u>Program switch position</u>	<u>Testing of</u>	<u>additional operation</u>	<u>Test specifications (Reading)</u>	<u>Cause of trouble</u>
21	Hydraulic modulator pressure buildup	Press key FR. Switch on both brake rollers. Press brake pedal and hold constant at 2000 N. Press illuminated key	Right-hand brake analyzer reading moves to an intermediate value and rises again to FR : 800 ... 1700 N	<ul style="list-style-type: none"> ● Brake lines mixed up? ● Conventional braking system O.K.? ● Hydraulic modulator defective. <p><u>Note:</u> Replace hydraulic modulator only as a complete unit. Repairing is not allowed. Danger!</p>
22	Hydraulic modulator pump delivery	Switch on brake rollers. Read off inherent friction value. Press key FA. Press brake pedal and hold constant at 2000 N. Press illuminated key.	After an intermediate value on both sides, return pump switches on briefly. Reading on both sides must drop below inherent friction value plus max. 200 N. Press illuminated key until reading rises again to 2000 N.	<ul style="list-style-type: none"> ● Hydraulic modulator defective. <p><u>Note:</u> Replace hydraulic modulator only as a complete unit. Repairing is not allowed. Danger!</p>

<u>Rear axle:</u> Drive rear wheels of vehicle onto brake analyzer.				
23	Wheel-speed sensor signal	Press key RA, switch on both brake rollers	RA : 1.9 ... 19	<ul style="list-style-type: none"> ● Wheel-speed sensors mixed up? ● Air gap too great. ● Respective wheel-speed sensor defective.



<u>Program switch position</u>	<u>Testing of</u>	<u>additional operation</u>	<u>Test specifications (Reading)</u>	<u>Cause of trouble</u>
20	Hydraulic modulator Pressure reduction	Press key RA. Switch on both brake rollers. Press brake pedal and hold constant at <u>2000 N</u> . Allowable difference between both wheels max. 500 N. Press illuminated key.	RA: <u>less than 1100 N</u>	<ul style="list-style-type: none"> ● Brake lines mixed up? ● Conventional braking system O.K.? ● Hydraulic modulator defective. <p><u>Note:</u> Replace hydraulic modulator only as a complete unit. Repairing not allowed. Danger!</p>
21	Hydraulic modulator Pressure buildup	Press key RA, switch on both brake rollers. Press brake pedal and hold constant at <u>2000 N</u> . Press illuminated key.	Brake analyzer readings on both sides move to an intermediate value and rise again to RA : <u>600 ... 1700 N</u>	
22	Hydraulic modulator Pump delivery	Switch on brake rollers. Read off inherent friction value. Press key RA. Press brake pedal and hold constant at <u>2000 N</u> .	After an intermediate value on both sides, return pump switches on briefly. Readings on both sides must drop below inherent friction <u>value plus max. 200 N.</u>	<ul style="list-style-type: none"> ● Hydraulic modulator defective. <p><u>Note:</u> Replace hydraulic modulator only as a complete unit. Repairing not allowed. Danger!</p>

Finally, conduct a road test.

With the engine running, the indicator lamp must go out.

Drive at at least 30 km/h.

The indicator lamp must not come on again.

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Rapid diagnosis chart

Mercedes Benz type W 124

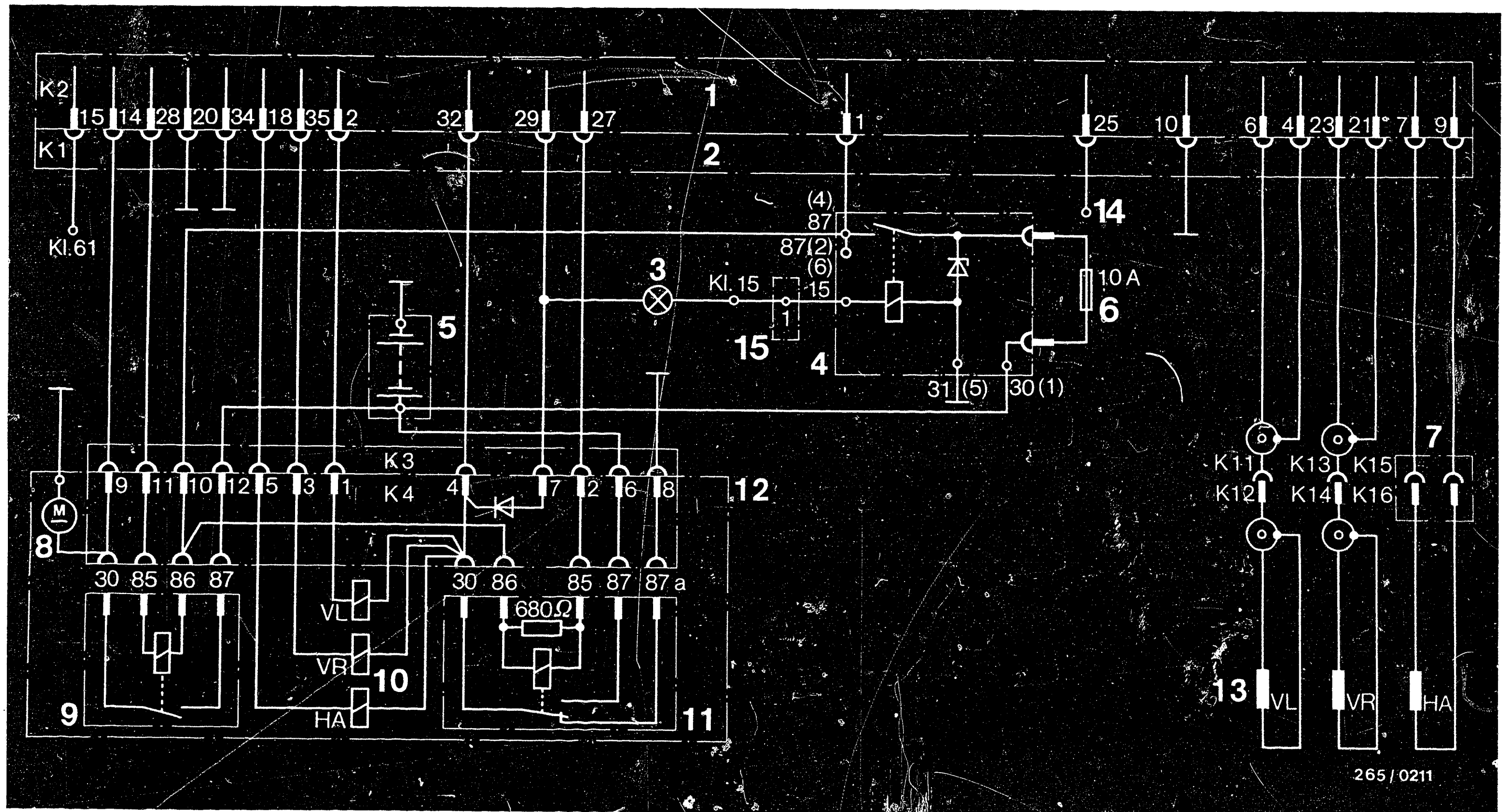


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Rapid diagnosis chart

Mercedes Benz type W 124





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- | | |
|----------------------------------|--------------------------|
| 1 = Electronic control unit | 6 = Plug-in fuse |
| 2 = Multiple plug (35-pin) | 7 = Cable connector |
| 3 = ABS warning lamp | 8 = Return pump motor |
| 4 = Overvoltage protection relay | 9 = Motor relay |
| 5 = Battery | 10 = Solenoid-op. valves |

- | |
|------------------------------|
| 11 = Valve relay |
| 12 = Hydraulic modulator |
| 13 = Wheel-speed sensor |
| 14 = To stop-lamp switch (+) |
| 15 = Plug connector 12-pin |

- | |
|-----------------------|
| VL = FL (front left) |
| VR = FR (front right) |
| HA = RA (rear axle) |
| K 1 to K 16 = |
| ABS plug connectors |

5. ELECTRICAL TERMINAL DIAGRAM

A18

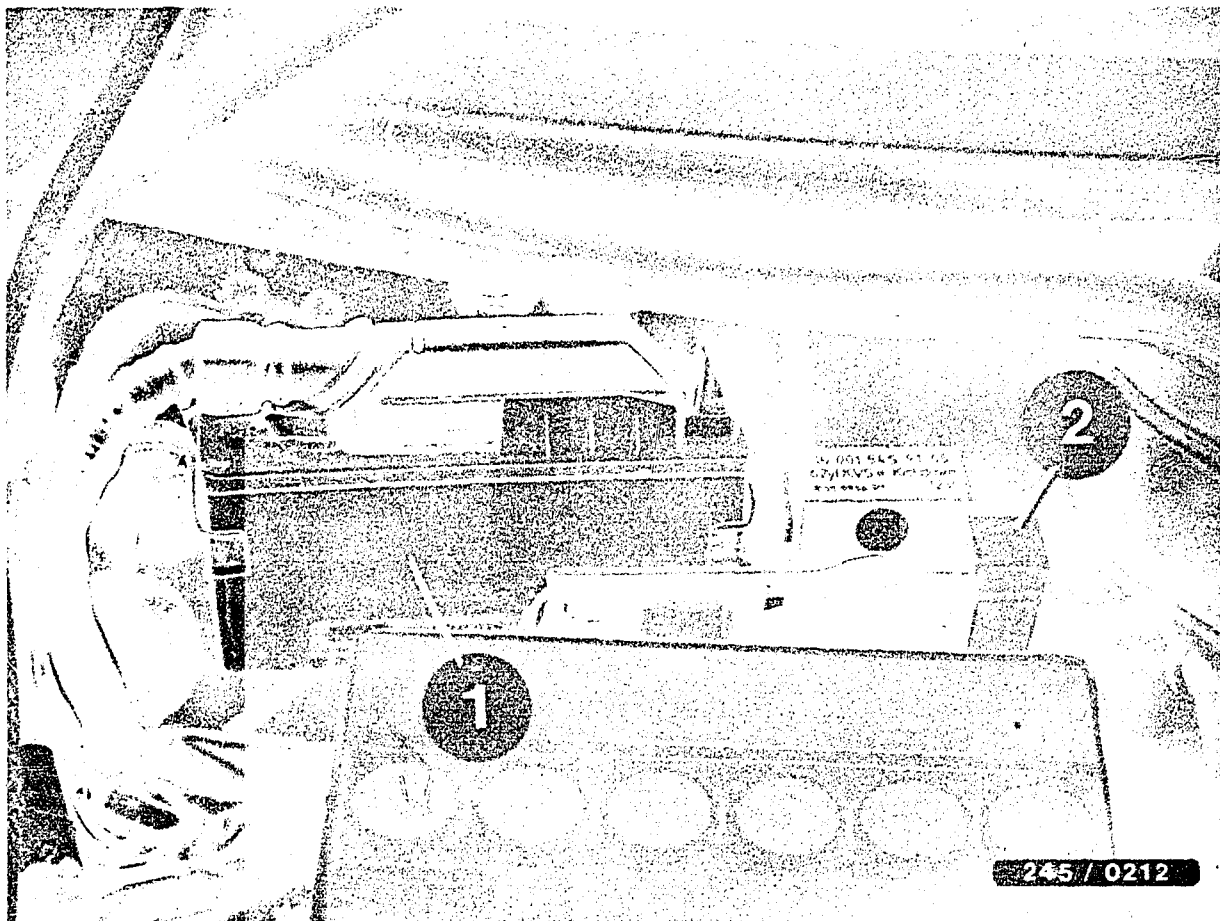
Electrical terminal diagram
Mercedes Benz type W 124



A19

Electrical terminal diagram
Mercedes Benz type W 124





1 = ABS control unit

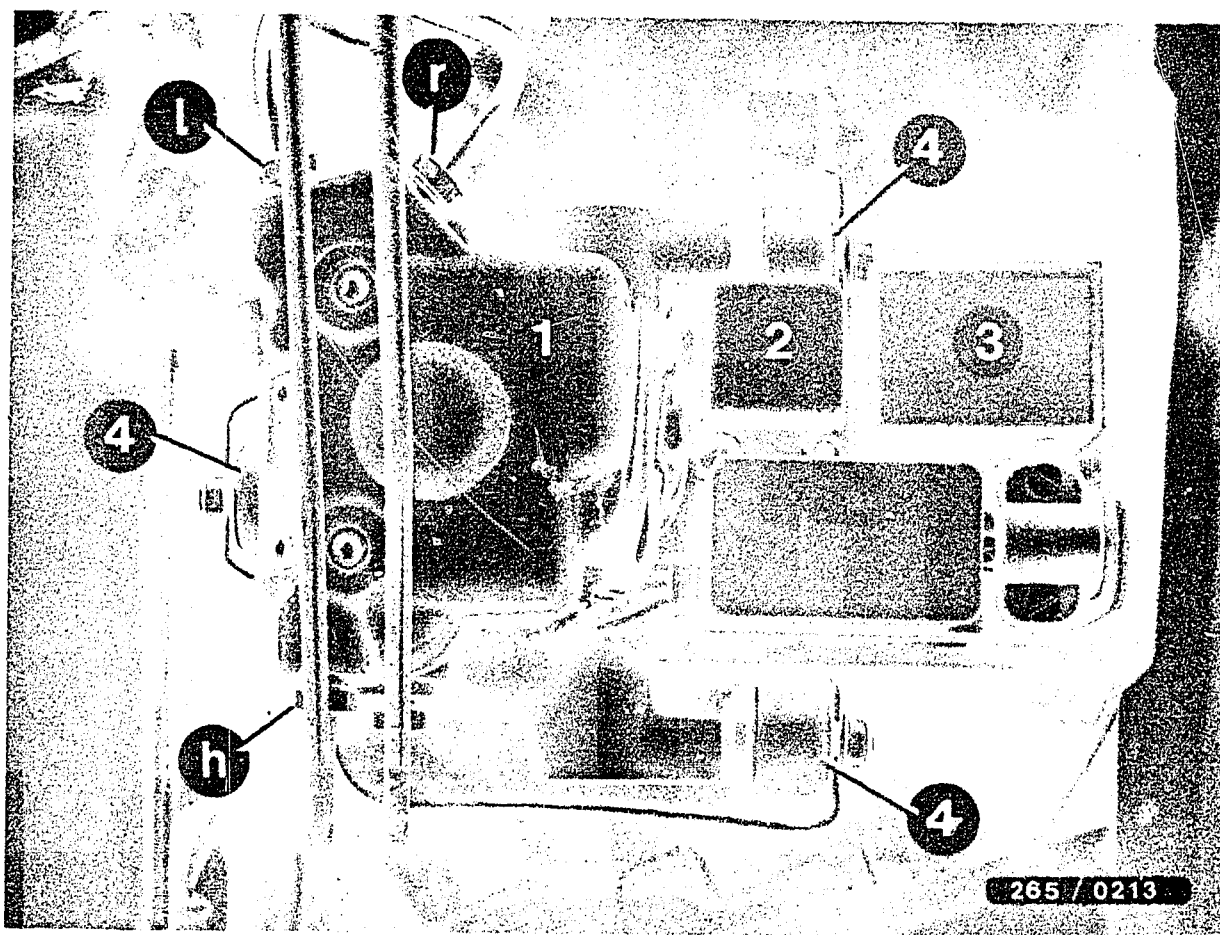
2 = Overvoltage protection relay

6. INSTALLATION POSITION OF COMPONENTS

The indications "right" and "left" apply always as viewed in the forward direction of travel.

- Control unit:
In equipment space on right, behind battery.
- Overvoltage protection relay:
In equipment space on right, near control unit.
- ABS warning lamp:
In instrument panel





1 = Hydraulic modulator
2 = Valve relay

3 = Motor relay
4 = Mountings

- Front-axle wheel-speed sensors:
One each on left and right in steering knuckles.
- Rear-axle wheel-speed sensor:
Only 1 wheel-speed sensor on rear axle housing.
- Hydraulic modulator:
In engine compartment at front left.
- ABS ground terminal:
Behind instrument cluster, bottom left, near plug connections of central-electrics box.



7. TEST EQUIPMENT AND TOOLS

Description	Designation	Part No.
<u>ABS tester</u> Use only converted tester. Identification "U2" on nameplate or as of FD 352	ETT 016.00	0 684 101 600
<u>Brake analyzer</u>	e.g. BPS 100 or BPS 101 or BPS 104 or BPS 105	0 680 012 .. 0 680 013 .. 0 680 018 .. 0 680 019 ..
<u>Filling and discharging device</u>		e.g. ATE Part No. 3.9302-1000.4 ¹⁾
<u>Bleeder fitting</u> For connection of filling and discharging device to master cylinder fluid reservoir		ATE Part No. 3.9302.0702.2 ¹⁾
<u>Bleeder hose</u>		ATE Part No. 3.3590.2300.1 ¹⁾
<u>Auxiliary hose</u>		ATE Part No. 3.9302.0704.2 ¹⁾
<u>Brake pedal actuating device</u>		ATE Part No. 3.9312.0100.4 ¹⁾

1) = obtainable from Alfred Teves GmbH, Guerickestraße 7
6000 Frankfurt (Main)



Description	Designation	Part No.
<u>Pressure tester</u> Tester for low- and high-pressure testing of hydraulic brake systems		e.g. ATE Part No. 3.9305-0200.4 1)
<u>Double-end box</u> <u>wrench</u> open 9 x 11 mm		Hazet Part No. 612 2)
<u>Vessel</u> for collecting the brake fluid approx. 1 l		
<u>Brake fluid</u>	Use only ATE genuine brake fluid DOT 4 or Mercedes-Benz brake fluid.	
<u>Electrics tester</u> or <u>Multimeter</u> for trouble- shooting	ETE.014.00	0 684 101 400 commercially available

1) = obtainable from: Alfred Teves GmbH
Guerickestr. 7
6000 Frankfurt (Main)

2) Firma Hazet
5630 Remscheid



7.1 Additional equipment

Use only Daimler Benz genuine brake lines.

<u>Description</u>	<u>Part No.</u>
Grease for wheel-speed sensors	Molykote Longterm 2
Protective caps for brake lines	Bosch Part No. 1 900 508 002 (100 pieces)
Protective caps for brake line connections on hydraulic modulator	1 900 508 004 (100 pieces)



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SPECIAL FEATURES

This microcard contains the ABS trouble-shooting instruction, valid at the time of publication, for the following models:

BMW 525i, 528i (9.81→)
520i (3.82→), 525e (5.83→), 524d (9.83→)



1. Test specifications

Due to considerations of safety, the ABS is to be tested only using the ABS tester. The rapid diagnostic chart contains all important test specifications and instructions for testing and for trouble-shooting.

2. PREREQUISITES FOR TESTING WITH THE ABS TESTER

- The tester must be converted to the most recent technical status (identification "U2" on the type designation plate or built after FD 352).
- Check the ground connection of the return pump and the overvoltage protection relay Term. 31 for firm seat and corrosion.
- Check hydraulic connections and seals on the hydraulic modulator for leaks (visual inspection).
- If the ABS signal light comes on from time to time during the trip (e.g., after switching-on load instruments) and goes back off on its own, check the battery and the power supply (alternator, controller, and voltage drops).
- If the ABS signal light is on continuously and does not go out, check the following points:
 - Is the multi-pole plug on the controller properly seated, and has it caught?
Are all plug contacts OK?
Are spring contacts latched in place?
 - Is the V-belt torn? (The alternator does not provide any voltage, the charge indicator light and the ABS signal light turn on).
 - Is alternator Term. 61 providing voltage?
Are the plug connection and the lead to the ABS controller OK?
 - Check for loose contacts for the wheel speed sensors with the program switch in setting 10.



- To test with the tester, switch the ignition on in all program switch settings (tester operates using the power supply from the vehicle battery).
- Watch tester lights 1 and 2 in all settings of the program switch.

N.B.!

Do not drive with the tester connected to the vehicle!

The entire testing program is to be repeated after every repair.

General instruction for trouble-shooting

Check all leads for grounding and contact with + leads and watch for worn or crimped spots.

- Connect the ABS tester to the controller and ABS wiring harness.

N.B.!

Disconnect and plug in the controller only with the ignition switched off.

The installation location for the controller is behind a cover in the glove compartment. Take out the Jetronic control unit if there is one there.



3. RAPID DIAGNOSTIC CHART FOR THE ABS TESTER

Switch the ignition on in all settings of the program switch.

<u>Program switch setting</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specification (Reading)</u>	<u>Cause of defect</u>
1...24	Power supply for each test step	----	Light 1 (green) must light up in every test step	<ul style="list-style-type: none"> ● Charge on battery inadequate. Repeat test step with engine running. ● Too great voltage drops at the terminals (e.g. ground terminal). ● Ground connection broken.
1	Valve relay at rest	----	Light 1 (green) and light 3 (green) must light up.	<ul style="list-style-type: none"> ● Leads (including ground lead) to the valve relay have a break or have excessive contact resistance. ● Valve relay defective.
2	Valve relay - operation	----	Lights 1 (green) and 3 (green) must light up.	
3	Return-pump relay - at rest	----	Lights 1 (green) and 3 (green) must light up.	<ul style="list-style-type: none"> ● Leads to the return-pump relay have breaks or have too great a contact resistance. ● Return-pump relay defective. ● Check pump motor for continuity.
4	Return-pump relay - operation	Press the illuminated button	Lights 1 (green) and 3 (green) must light up, pump motor runs	

B4

Rapid diagnostic chart

BMW, 5 series



B5

Rapid diagnostic chart

BMW, 5 series



Program switch setting	Testing of	Additional operation	Test specification (reading)	Cause of defect
5	Overvoltage protection in the controller	Pull the overvoltage protection out of the test socket that is located on the back of the ABS tester. Press the illuminated button.	Lights 1 (green) and 3 (green) must light up.	<ul style="list-style-type: none"> Repeat test. Controller defective.
6	Internal resistances of the solenoid-operated valves in the hydraulic modulator	Switch ignition off. Connect controller. Switch ignition on. Press button VL Press button VR Press button HL Press button HR	Light 1 (green) must light up. VL: 0.7...1.7 Ω VR: 0.7...1.7 Ω HL: 0.7...1.7 Ω HR: 0.7...1.7 Ω	<ul style="list-style-type: none"> Leads to the valve in question have breaks or have excessive contact resistance Hydraulic modulator defective.
7	Ground connection to Term. 10	Press illuminated button	Light 1 (green) must light up. 30...300 mV	<ul style="list-style-type: none"> Ground connection or ground terminal have breaks or have excessive contact resistance.
8	Ground connection to Term. 34	Press illuminated button	Light 1 (green) must light up. 10...250 mV	
9	Ground connection to Term. 20	Press illuminated button	Light 1 (green) must light up. 10...250 mV	

B6

 Rapid diagnostic chart
 BMW, 5 series

B7

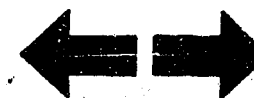
 Rapid diagnostic chart
 BMW, 5 series


<u>Program switch setting</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specification (reading)</u>	<u>Cause of defect</u>
10	Internal resistances of the wheel speed sensors	Press button VL Press button VR Press button HL Press button HR	Light 1 (green) must light continually. VL: 0.8...1.8 kΩ VR: 0.8...1.8 kΩ HL: 0.6...1.6 kΩ HR: 0.6...1.6 kΩ	<ul style="list-style-type: none"> • Check for loose contact: Move all leads at their fastening points, on the plug and on the wheel speed sensor and watch the reading. • The leads to the wheel speed sensor in question have breaks or have excessive contact resistance. • The wheel speed sensor in question is defective.
11	Insulation resistances of the wheel speed sensors	Press button VL Press button VR	Light 1 (green) must light up continually. VL: 20...999 kΩ VR: 20...999 kΩ HL: 20...999 kΩ HR: 20...999 kΩ	<ul style="list-style-type: none"> • Check leads to the wheel speed sensor in question or damage to the insulation. • Wheel speed sensor in question is defective.
12	DC voltage on the wheel speed sensor leads	Press button VL Press button VR Press button HL Press button HR	Light 1 (green) must light up continually. VL: 000...100 mV VR: 000...100 mV HL: 000...100 mV HR: 000...100 mV	<ul style="list-style-type: none"> • Check leads to the wheel speed sensor in question for contact (wear spot) with a + lead. • Wheel speed sensor in question is defective.
13	Internal power supply within controller	Press illuminated button	8.85...9.15 V For generation 2B after 9.83: 4.75...5.25 V	<ul style="list-style-type: none"> • Controller defective.

B8

Rapid diagnostic chart
BMW, 5 series

B9

Rapid diagnostic chart
BMW, 5 series


<u>Program switch setting</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specifications (reading)</u>	<u>Cause of defect</u>
14	Diode in forward direction and ABS signal light		0.4...1.5 V ABS signal light in the vehicle must light up.	<ul style="list-style-type: none"> Leads to the diode and/or the signal light have breaks or contact resistance. Signal light defective. Diode (hydraulic moderator) defective.
15	Diode in blocking direction		2.5...8.5 V ABS signal lights somewhat more dimly.	<ul style="list-style-type: none"> Diode (hydraulic modulator) defective.
16	Controller BITE* triggering	Press illuminated button for 3 seconds	Signal light must go off after max. 1 second.	<ul style="list-style-type: none"> Controller defective.
17	Controller, BITE*-simulation of defect	Press illuminated button for 3 seconds	Signal light must stay on (flickering allowable).	<ul style="list-style-type: none"> Controller defective.
18	Controller, current for maintaining pressure	Press button VL, press illuminated button Press button VR, press illuminated button Press button HL, press illuminated button Press button HR, press illuminated button	VL: 1.9...2.3 A VR: 1.9...2.3 A HL: 1.9...2.3 A HR: 1.9...2.3 A	<ul style="list-style-type: none"> Controller defective.
19	Controller, current for pressure reduction	Press button VL, press illuminated button Press button VR, press illuminated button Press button HL, press illuminated button Press button HR, press illuminated button	VL: 4.5...6.0 A VR: 1.9...2.3 A HL: 4.5...6.0 A HR: 4.5...6.0 A	<ul style="list-style-type: none"> Controller defective
24	Voltage from brake light switch	Step on brake pedal	Only for generation 2B after 9.83: 10...15 V	<ul style="list-style-type: none"> Lead to the brake light switch defective. Brake light switch defective. Brake lights defective.

*BITE = Built-in test circuit

B 10

Rapid diagnostic chart
BMW, 5 series



B 11

Rapid diagnostic chart
BMW, 5 series



A brake analyzer (BTS) is required for program switch settings 20, 21, 22, and 23.
Do not drive the vehicle with the tester connected! Do not use a brake pedal actuator to adjust the brake force! Be certain to do program switch setting 23 first.

Front axle

Drive vehicle with front wheels on the brake analyzer. Put on hand brake.

<u>Program switch setting</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specifications (reading)</u>	<u>Cause of defect</u>
23	Wheel speed sensors - checking signal and that sensors have not been exchanged one for the other	Press button VL, switch on left brake roller.	<u>VL: 1.2...19</u>	<ul style="list-style-type: none"> • Have wheel speed sensors been exchanged for one another? • Air gap too large. • Wheel speed sensor in question is defective.
		Press button VR, switch off left brake roller, switch on right brake roller.	<u>VR: 1.2...19</u>	
20	Hydraulic modulator - checking pressure reduction and for mistaken connections	Press button VR. Switch on right brake roller. Step on brake pedal and hold constant at 2000 N. Press illuminated button.	<u>VR: 500...1000 N</u>	<ul style="list-style-type: none"> • Final test reading may vary by max. 200 N in 3 seconds. • Have brake leads been mistaken for one another? • Is conventional brake system OK? • Hydraulic modulator defective. <p><u>Note:</u> Take out and replace the hydraulic modulator only as a complete unit. Repair is not allowable. Danger! Can be fatal!</p>
		Press button VL. Switch off right brake roller. Switch on left brake roller. Step on brake pedal and hold constant at 2000 N. Press illuminated button.	<u>VL: 500...1000 N</u>	
21	Hydraulic modulator - pressure build-up	Press button VL, switch on both brake rollers. Step on brake pedal and hold constant at 2000 N. Allowable difference between the two wheels max. 400 N. Press illuminated button.	Reading on the brake analyzer on the left goes to an interim value and then increases again to <u>VL: 600...1400 N</u>	

B12

Rapid diagnostic chart
BMW, 5 series



B13

Rapid diagnostic chart
BMW, 5 series



Program switch setting	Testing of	Additional operation	Test specifications (reading)	Cause of defect
21	Hydraulic modulator - pressure build-up	Press button VR. Switch on both brake rollers. Step on brake pedal and hold constant at 2000 N. Press illuminated button.	Reading of the brake analyzer on the right goes to an interim value and then increases again to <u>VR: 600...1400 N</u>	<ul style="list-style-type: none"> • The final test reading may vary by max. 400 N in 3 seconds. • Have brake leads been exchanged for one another? • Is conventional brake system OK? • Hydraulic modulator is defective. <p>Note: Take out and replace the hydraulic modulator only as a complete unit. Repair is not allowable. Danger! Can be fatal!</p>
22	Hydraulic modulator - pump delivery, first brake circuit	Switch on brake rollers. Read the intrinsic friction value on the right. Press button VR. Step on brake pedal and hold constant at 2000 N. Press illuminated button.	After an interim value on the right, the return pump switches on briefly. The reading on the right must drop below the <u>intrinsic friction value plus 200 N</u> . Keep pressing the illuminated button until the reading rises again to 2000 N.	<ul style="list-style-type: none"> • Hydraulic modulator defective. <p>Note: Take out and replace the hydraulic modulator only as a complete unit. Repair is not allowable. Danger! Can be fatal!</p>
	Hydraulic modulator - pump delivery, second brake circuit	Switch on brake rollers. Read the intrinsic friction value on the left. Press button VR. Step on brake pedal and hold constant at 2000 N. Press illuminated button.	After an interim value on the left, the return pump switches on briefly. The reading on the left must drop below the <u>intrinsic friction value plus 200 N</u> . Keep pressing the illuminated button until the reading rises again to 2000 N.	

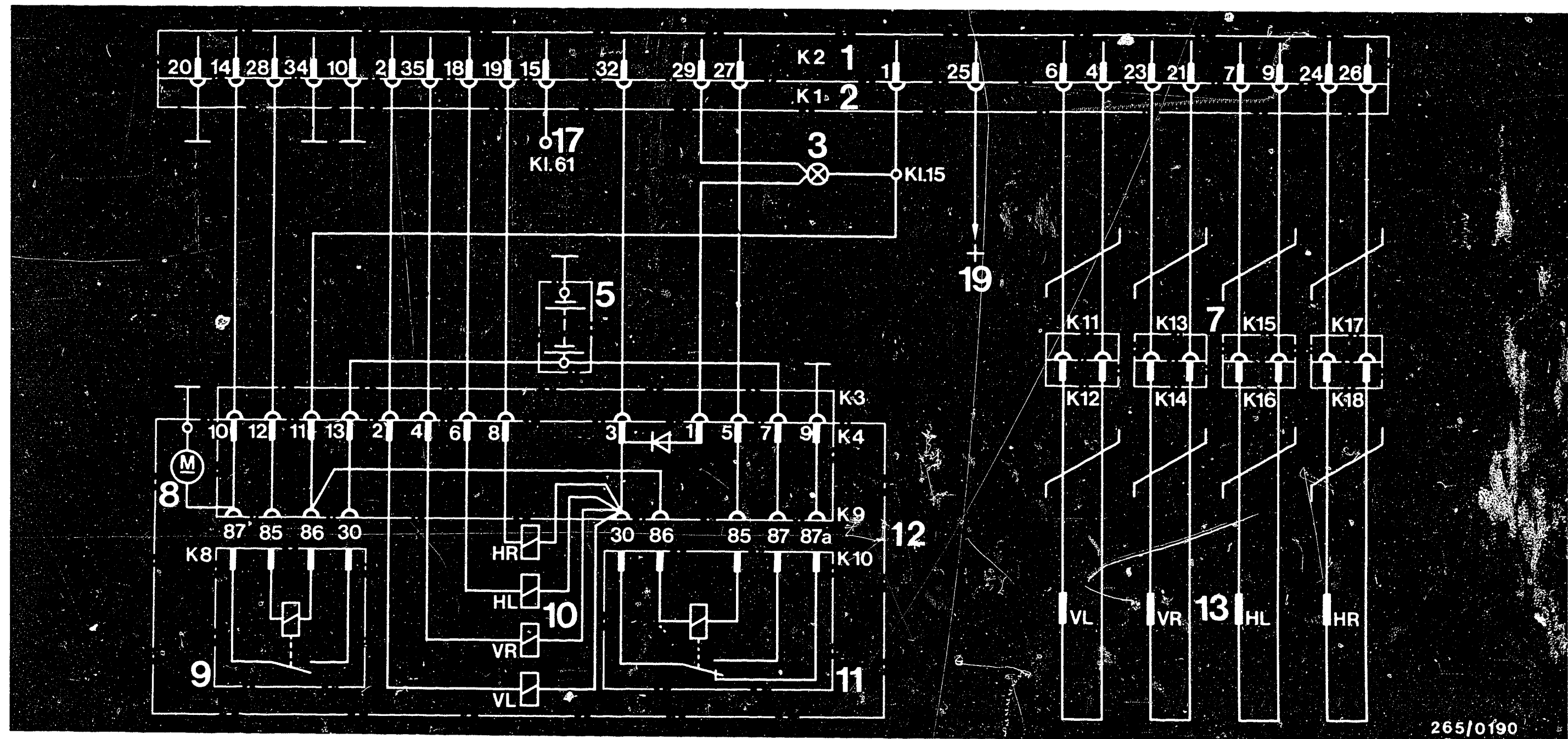


Rear axle: Drive vehicle with the rear wheels on the brake analyzer. Release the hand brake.
For vehicles with automatic transmissions, put into neutral.

Program switch setting	Testing of	Additional operation	Test specifications (reading)	Cause of defect
23	Wheel speed sensors - checking signal and that sensors have not been exchanged one for the other	Press button HL, switch on left brake roller.	HL: 1.2...19	<ul style="list-style-type: none"> ● Have wheel speed sensors been exchanged for one another? ● Air gap too large. ● Wheel speed sensor in question is defective.
		Press button HR, switch off left brake roller, switch on right brake roller.	HR: 1.2...19	
20	Hydraulic modulator - pressure reduction and checking for mistaken connections	Press button HR. Switch on right brake roller. Step on brake pedal and hold constant at 1500 N. Press illuminated button.	HR: 500...1000N *) 400...900 N **)	<ul style="list-style-type: none"> ● Final test reading may vary by max. 200 N in 3 seconds. ● Have brake leads been mistaken for one another? ● Is conventional brake system OK? ● Hydraulic modulator defective. <p><u>Note:</u> Take out and replace the hydraulic modulator only as a complete unit. Repair is not allowable. Danger! Can be fatal!</p>
		Press button HL. Switch off brake roller. Switch off left brake roller. Step on brake pedal and hold constant at 1500 N. Press illuminated button.	HL: 500...1000N *) 400...900 **)	
21	Hydraulic modulator - pressure build-up	Press button HL. Switch on both brake rollers. Step on brake pedal and hold constant at 1500 N. Allowable difference between the two wheels max. 400 N. Press illuminated button.	Reading on the brake analyzer on the left goes to an interim value and then increases again to HL: 500...1100 N *) 400...1000 N **)	<p>*) Valid for hydraulic modulator 0 265 201 005, which may be installed only in the 528i and 525i (up to 3.82) with a 13° helical suspension rear axle.</p> <p>**) Valid for hydraulic modulator 0 265 201 004, which can be installed in all models of the 5 series.</p>
		Press button HR. Switch on both brake rollers. Step on brake pedal and hold constant at 1500 N. Press illuminated button.	Reading on the brake analyzer on the right goes to an interim value and then increases again to HR: 500...1100 N *) 400...1000 N **)	

Do a test drive as final test. The signal light must go out when the engine is running. Drive at least 30 km/hr. When this is done, the signal light must not come back on.





265/0190

4. ELECTRIC CIRCUIT DIAGRAM ABS

- 1 = Electronic controller
- 2 = Multiple plug (35-pole)
- 3 = ABS signal light
- 5 = Battery
- 7 = Plug connections
- 8 = Return pump motor
- 9 = Return pump relay

- 10 = Solenoid-operated valve
- 11 = Valve relay
- 12 = Hydraulic modulator
- 13 = Wheel speed sensor
- 17 = to the alternator
- 19 = to the brake light switch
(after generation 2B)

- VL = left front
- VR = right front
- HL = left rear
- HR = right rear
- K1, K2 etc. = plug numbers

B 18

Electric circuit diagram
BMW, 5 series



B 19

Electric circuit diagram
BMW, 5 series

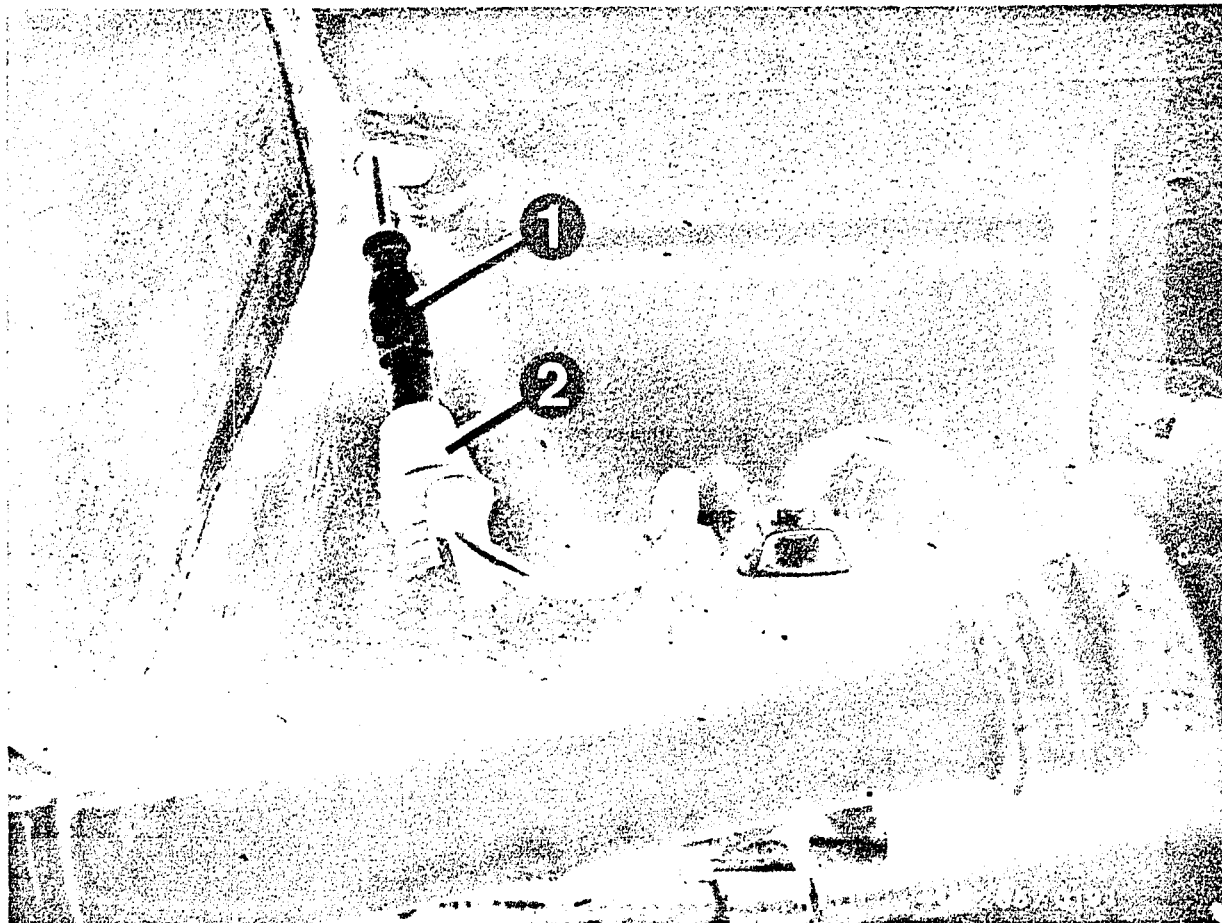


5. INSTALLATION POSITION OF THE COMPONENTS

Indication for installation position is always based on the forward direction of vehicle travel.

- ABS signal light: In the dashboard.
- Ground terminal for ABS: In the engine compartment, left front, near the battery.
- Controller: Behind the cover in the glove compartment. If there is a Jetronic control unit there, take it out.





- 1 = Plug connection for the wheel speed sensor, left rear, pulled out of the hole.
 2 = Rubber grommet

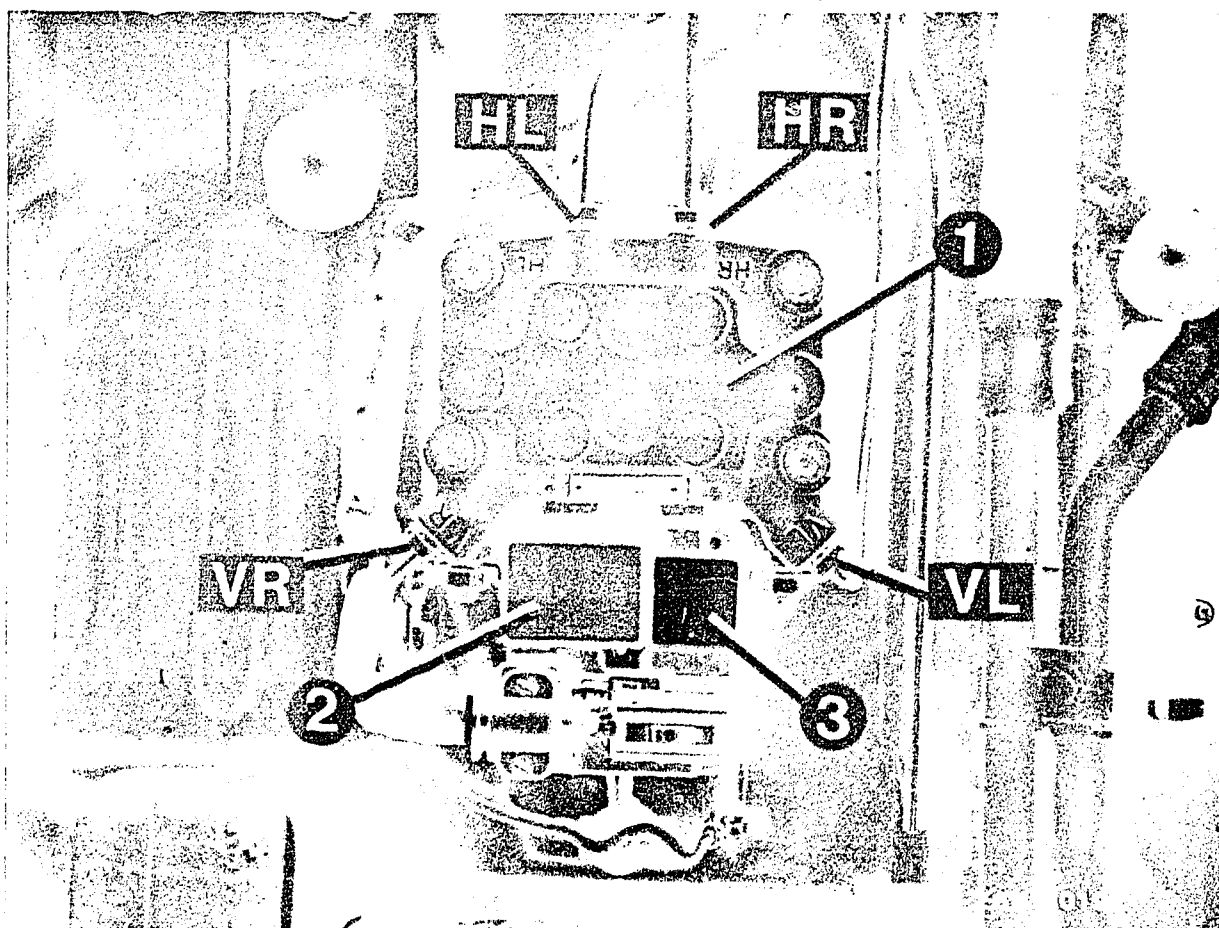
● Wheel speed sensors, front axle:

One each on the left and on the right, in the steering knuckles. The plug connections are located on the left and right in the engine compartment, on the wheel box, in a frame perpendicular to the McPherson struts.

● Wheel speed sensors, rear axle:

One each on the left and on the right near the disc-brake calipers.
 The wheel speed sensors are to be put on without washers. The plug connections are located under the vehicle, in rubber grommets that are inserted into the floor plate (Figure). Pull the rubber grommets out carefully.





1 = Hydraulic modulator

In the engine compartment, behind the right headlight.

VL = Brake line to left front wheel brake cylinder

VR = Brake line to right front wheel brake cylinder

HL = Brake line to left rear wheel brake cylinder

HR = Brake line to right rear wheel brake cylinder

2 = Return-pump relay

3 = Valve relay

It may be necessary to remove the air filter housing before taking out the hydraulic modulator.

Before taking off the cap, disconnect the ground lead from the gap.

It is not permissible to repair the hydraulic modulator.

It must be taken out and replaced as a complete unit.

Exception: Replacement of relays.



6. TEST EQUIPMENT AND TOOLS

Name	Designation	Part No.
<u>ABS tester</u> Use only retrofitted testers! Identification "U2" on type designation plate, or built after FD 352	ETT 016.00	0 684 101 600
<u>Brake analyzer</u>	e.g. BPS 100 or BPS 101 or BPS 104 or BPS 105	0 680 012 .. 0 680 013 .. 0 680 018 .. 0 680 019 ..
<u>Charging and bleeding device</u>		e.g. ATE Part No. 3.9302-1000.4 1)
<u>Bleeder fitting</u> To connect the charging and bleeding device at the equalizing reservoir of the master cylinder		ATE Part No. 3.9302.0702.2 1)
Bleeder hose		ATE Part No. 3.5909.2300.1 1)
Additional hose		ATE Part No. 3.9302.0704.2 1)
<u>Brake pedal actuator</u>		ATE Part No. 3.9312.0100.4 1)

1) Obtain from

Alfred Teves GmbH
 Guerickestraße 7
 6000 Frankfurt/Main

B23

Test equipment and tools

BMW, 5 series



Name	Designation	Part No.
Pressure tester Tester for high and low pressure testing of hydraulic brake systems		e.g. ATE Part No. 3.9305-0200.4 1)
Double-head box wrench, open 9 x 11 mm		Hazet Part No. 612 2)
<u>Pan</u> To catch the brake fluid, approx. 1 l <u>Brake fluid:</u> BMW-DOT 4 or ATE SL-DOT 4 or Veedol Disc Brake Fluid DOT 4 or Castrol Disc Brake Fluid DOT 4		
Electric tester or multitester for trouble-shooting	ETE 014.00	0 684 101 400 commercially available

6.1 Aids

Use only original brake leads from BMW!

Name	Part No.
Grease for wheel speed sensors	Molykote Longterm 2
Protective cap for brake leads	1 900 508 002 (100 Pcs.)
Protective cap for brake lead con- nections on the hydraulic modulator	1 900 508 004 (100 Pcs.)

- 1) Obtain from: Alfred Teves GmbH,
Guerickestraße 7
6000 Frankfurt/Main
- 2) Firma Hazet, 5630 Remscheid



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SPECIAL FEATURES

This microcard contains the ABS trouble-shooting instruction, valid at the time of publication, for the following models:

BMW 320i, 323i (9.83→)



1. TEST SPECIFICATIONS

Due to considerations of safety, only the ABS-Tester is to be used for testing the ABS.
The rapid diagnostic chart contains all important test specifications and instructions for testing and troubleshooting.

2. PREREQUISITES FOR TESTING WITH ABS-TESTERS

- The tester must be retrofitted to the newest technical condition (built after FD 352, or identification "U2" on the nameplate).
- Make certain the ground connection of the return pump and the overvoltage protection relay Term. 31 are tight and free of corrosion.
- Check hydraulic connections and joints on the hydraulic assembly for leaks (visual inspection).
- If the ABS signal light lights from time to time during the trip (e.g., after users switch on) and goes back off on its own, check the battery and the electrical supply (alternator, regulator, and voltage drops).
- If the ABS signal light lights continuously, and does not go out, check the following points:
 - Is the multipole plug on the controller properly seated?
Did it catch?
Plug contacts O.K.?
Did the spring contacts catch?
 - Is the V-belt torn? (The alternator does not provide any electricity, the charge indicator light and the ABS signal light turn on).
 - Is there electricity from alternator Term. 61?
Are the plug connection and the lead to the ABS controller O.K.?
 - Be especially careful in checking for loose contacts for the wheel speed sensor in program switch setting 10.



- For testing with the tester, switch the ignition on in all settings of the program switch (the tester works with power supplied from the vehicle battery).
- Watch tester lights 1 and 2 in all settings of the program switch.

Caution!

Do not drive the vehicle with the tester connected to it!

After every repair, the entire test program is to be repeated.

General instructions for trouble-shooting

Check all leads for ground and contact to positive. Watch for wear and crimping.

- Connect the ABS-Tester to the controller and to the ABS wiring harness.

Caution!

Connect and disconnect the controller only when the ignition is off.

The controller is located behind the cover on the left of the steering wheel column.



3. RAPID DIAGNOSTIC CHART FOR THE ABS-TESTER

Switch on the ignition in all settings of the program switch.

<u>Program switch setting</u>	<u>Object tested</u>	<u>Additional procedure</u>	<u>Test specification (Reading)</u>	<u>Cause of defect</u>
1...24	Electrical supply in every step of testing	-----	Light 1 (green) must turn on in every test step	<ul style="list-style-type: none"> ● Battery is not sufficiently charged. Repeat test step with engine running. ● Excessive voltage drops at the terminals (e.g., ground terminal). ● Overvoltage protection relay is defective. ● Break in the ground connection.
1	Valve relay - at rest	-----	Light 1 (green) and 3 (green) must turn on.	<ul style="list-style-type: none"> ● The leads (including the ground lead) to the valve relay have breaks, or too high a contact resistance. ● Valve relay is defective.
2	Valve relay - operation	-----	Light 1 (green) and 3 (green) must turn on.	
3	Return-pump relay at rest	-----	Light 1 (green) and 3 (green) must turn on.	<ul style="list-style-type: none"> ● Leads to the return-pump relay have breaks or too high a contact resistance. ● Return-pump relay is defective. ● Check the pump motor for continuity.
4	Return-pump relay operation	Press the illuminated button	Lights 1 (green) and 3 (green) must turn on, pump motor runs.	

C4

Rapid diagnostic chart

BMW 320i / 323i



C5

Rapid diagnostic chart

BMW 320i / 323i



<u>Program switch setting</u>	<u>Object tested</u>	<u>Additional procedure</u>	<u>Test specification (Reading)</u>	<u>Cause of defect</u>
5	Overvoltage protection relay (only built-in fuse and Zener diode)	Switch off ignition. Disconnect regulator device. Take the overvoltage protection relay out of the vehicle and plug in to the socket on the tester. Plug in new overvoltage protection relay into the vehicle. Turn on the ignition. Press the illuminated button.	Lights 1 (green) and 3 (green) must turn on.	<ul style="list-style-type: none"> The overvoltage protection relay in the socket on the tester is defective.
6	Internal resistances of the solenoid valves in the hydraulic modulator	Switch off the ignition. Connect the controller again. Turn on the ignition. Press button VL Press button VR Press button HA	Light 1 (green) must turn on. VL: 0.7...1.7 Ω VR: 0.7...1.7 Ω HA: 0.7...1.7 Ω	<ul style="list-style-type: none"> The leads to the valve in question have breaks or too high a contact resistance. The hydraulic modulator is defective.
7	Ground connection to Term. 10	Press the illuminated button	Light 1 (green) must turn on. 80 ... 300 mV	<ul style="list-style-type: none"> The ground connection and the ground terminal have a break or have too high a contact resistance.
8	Ground connection to Term. 34	Press the illuminated button	Light 1 (green) must turn on. 10 ... 250 mV	
9	Ground connection to Term. 20.	Press the illuminated button	Light 1 (green) must turn on. 10 ... 250 mV	

C6

Rapid diagnostic chart

BMW 320i /323i


C7

Rapid diagnostic chart

BMW 320i / 323i



<u>Program switch setting</u>	<u>Object tested</u>	<u>Additional procedure</u>	<u>Test specification</u>	<u>Cause of defect</u>
10	Internal re- sistances of the wheel speed sensors	Press button VL Press button VR Press button HL Press button HR	Light 1 (green) must stay lit. VL: 0.6 ... 1.6 k Ω VR: 0.6 ... 1.6 k Ω HL: 0.6 ... 1.6 k Ω HR: 0.6 ... 1.6 k Ω	<ul style="list-style-type: none"> • Check for loose contacts: Move all leads at the fastening points, at the plug and at the wheel speed sensors and watch the readings. • The leads to the wheel speed sensor in question have breaks or too high a contact resistance. • The wheel speed sensor in question is defective.
11	Insulation resistances of the wheel speed sensors	Press button VL Press button VR Press button HL Press button HR	Light 1 (green) must stay lit. VL: 20 ... 999 k Ω VR: 20 ... 999 k Ω HL: 20 ... 999 k Ω HR: 20 ... 999 k Ω	<ul style="list-style-type: none"> • Check leads to the wheel speed sensor in question for damage to the insulation. • Wheel speed sensor in question is defective.
12	DC voltage on the wheel speed sensor leads	Press button VL Press button VR Press button HL Press button HR	Light 1 (green) must stay lit. VL: 000 ... 100 mV VR: 000 ... 100 mV HL: 000 ... 100 mV HR: 000 ... 100 mV	<ul style="list-style-type: none"> • Check the leads to the wheel speed sensor in question for contact (wear location) to a plus-lead. • Wheel speed sensor in question is defective.
13	Internal power supply within controller	Press the illuminated button	4.75 ... 5.25 V	<ul style="list-style-type: none"> • Controller defective.



<u>Program switch setting</u>	<u>Object tested</u>	<u>Additional procedure</u>	<u>Test specification</u>	<u>Cause of defect</u>
14	Diode in forward direction and ABS signal light		0.4 ... 1.5 V ABS signal light in the vehicle must turn on.	<ul style="list-style-type: none"> Leads to the diode and/or the signal light have breaks or contact resistance. Signal light is defective. Diode (hydraulic modulator) is defective.
15	Diode in the block direction		2.5 ... 8.5 V The ABS signal light lights somewhat more dimly.	<ul style="list-style-type: none"> Diode (hydraulic modulator) is defective.
16	Controller BITE* trigger	Press the illuminated button for 3 seconds	The signal light must go out after max. 1 sec.	<ul style="list-style-type: none"> Controller is defective
17	Controller, BITE* - simulation of defect	Press the illuminated button for 3 seconds	Signal light must stay lit (flickering allowable).	<ul style="list-style-type: none"> Controller is defective
18	Controller, current for maintaining pressure	Press button VL, Press illuminated butt. Press button VR, Press illuminated butt. Press button HA, Press illuminated butt.	VL: 1.9 ... 2.3 A VR: 1.9 ... 2.3 A HA: 1.9 ... 2.3 A	<ul style="list-style-type: none"> Controller is defective
19	Controller, current for dissipation of pressure	Press button VL Press illuminated butt. Press button VR Press illuminated butt. Press button HA Press illuminated butt.	VL: 4.5 ... 6.0 A VR: 4.5 ... 6.0 A HA: 4.5 ... 6.0 A	<ul style="list-style-type: none"> Controller is defective
24	Voltage from the brake light switch	Press brake pedal	10 ... 15 V	<ul style="list-style-type: none"> Lead to the brake light switch is defective. Brake light switch is defective. Brake lights are defective.

* BITE = Built-in testing circuit

C10

Rapid diagnostic chart

BMW 320i / 323i



C11

Rapid diagnostic chart

BMW 320i / 323i



For program switch settings 20, 21, 22, and 23, a brake testing stand (BPS) is required. Do not drive the vehicle with the tester connected to it! Do not use a brake pedal winch to adjust the braking force! Give absolute preference to program switch setting 23.

Front axle

Drive the vehicle with the front wheels on the brake test stand.

Put on the hand brake.

On vehicles with automatic transmissions, put the selector lever into "neutral".

[illegible]

<u>Program switch setting</u>	<u>Object tested</u>	<u>Additional procedure</u>	<u>Test specification (Reading)</u>	<u>Cause of defect</u>
21	Hydraulic modulator pressure build-up	Press button VR. Switch on both brake rollers. Push brake pedal and hold constant at 1500 N. Press the illuminated button.	The reading for the brake testing stand on the right goes to an intermediate value and rises back to <u>VR: 500 ... 1000 N</u>	<ul style="list-style-type: none"> Have the brake lines been exchanged, one for the other? Is the conventional brake system O.K.? Hydraulic modulator is defective. <u>Note:</u> Take out and replace the complete hydraulic modulator only. No repairs are permissible. Warning: Can be deadly!
22	Hydraulic modulator pump delivery	Switch on brake rollers. Take reading for internal friction. Press button VA. Press brake pedal and hold constant at 1500 N. Press illuminated button.	After an intermediate value on both sides, the return pump switches on briefly. The reading on both sides must drop to less than the internal friction plus <u>200 N</u> . The reading is displayed only for a short time!	<ul style="list-style-type: none"> The hydraulic modulator is defective. <u>Note:</u> Take and replace the complete hydraulic modulator only. No repairs are permissible. Warning! Can be deadly!

Rear axle: Drive the vehicle with the rear wheels on the brake test stand.

23	Wheel speed sensor - signal	Press button HL, switch on brake roller at left. Press button HR, switch off brake roller at left, switch on brake roller at right.	<u>HL: 1.8 ... 19</u> <u>HR: 1.8 ... 19</u>	<ul style="list-style-type: none"> Have the wheel speed sensors been exchanged, one for the other? Air gap too large. Wheel speed sensor in question is defective.
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C14

Rapid diagnostic chart

BMW 320i / 323i



C15

Rapid diagnostic chart

BMW 320i / 323i



<u>Program switch setting</u>	<u>Object tested</u>	<u>Additional procedure</u>	<u>Test specification (Reading)</u>	<u>Cause of defect</u>
20	Hydraulic modulator pressure reduction	Press button HA. Switch on both brake rollers. Press brake pedal and hold constant at <u>1500 N</u> . Press illuminated button.	<u>HA: 400...1000 N</u>	<ul style="list-style-type: none"> ● Have the brake lines been exchanged, one for the other? ● Is the conventional brake system O.K.? ● Hydraulic modulator is defective. <p><u>Note:</u> Take out and replace the complete hydraulic modulator only. No repairs are permissible. Warning: Can be deadly!</p>
21	Hydraulic modulator pressure build-up	Press button HA, switch on both brake rollers. Press brake pedal and hold constant at <u>1500 N</u> . Press illuminated button.	Reading for the brake test stand on both sides goes to an intermediate value and rises again to <u>HA: 500 ... 1000 N</u>	
22	Hydraulic modulator pump delivery	Switch on brake rollers. Take reading for internal friction. Press button HA. Press brake pedal and hold constant at <u>1500 N</u>	After an intermediate value on both sides, the return pump switches on briefly. The reading on both sides must drop to a value below the <u>internal friction plus 200 N</u> . The reading is displayed only for a brief time!	<ul style="list-style-type: none"> ● Hydraulic modulator is defective. <p><u>Note:</u> Take out and replace the complete hydraulic modulator only. No repairs are permissible. Warning: Can be deadly!</p>

As a final test, do a test drive.

With the engine running, the signal light must go off.

Drive at least 30 km/h.

It is not permissible for the signal light to light up again when that is done.

C16

Rapid diagnostic chart

BMW 320i / 323i

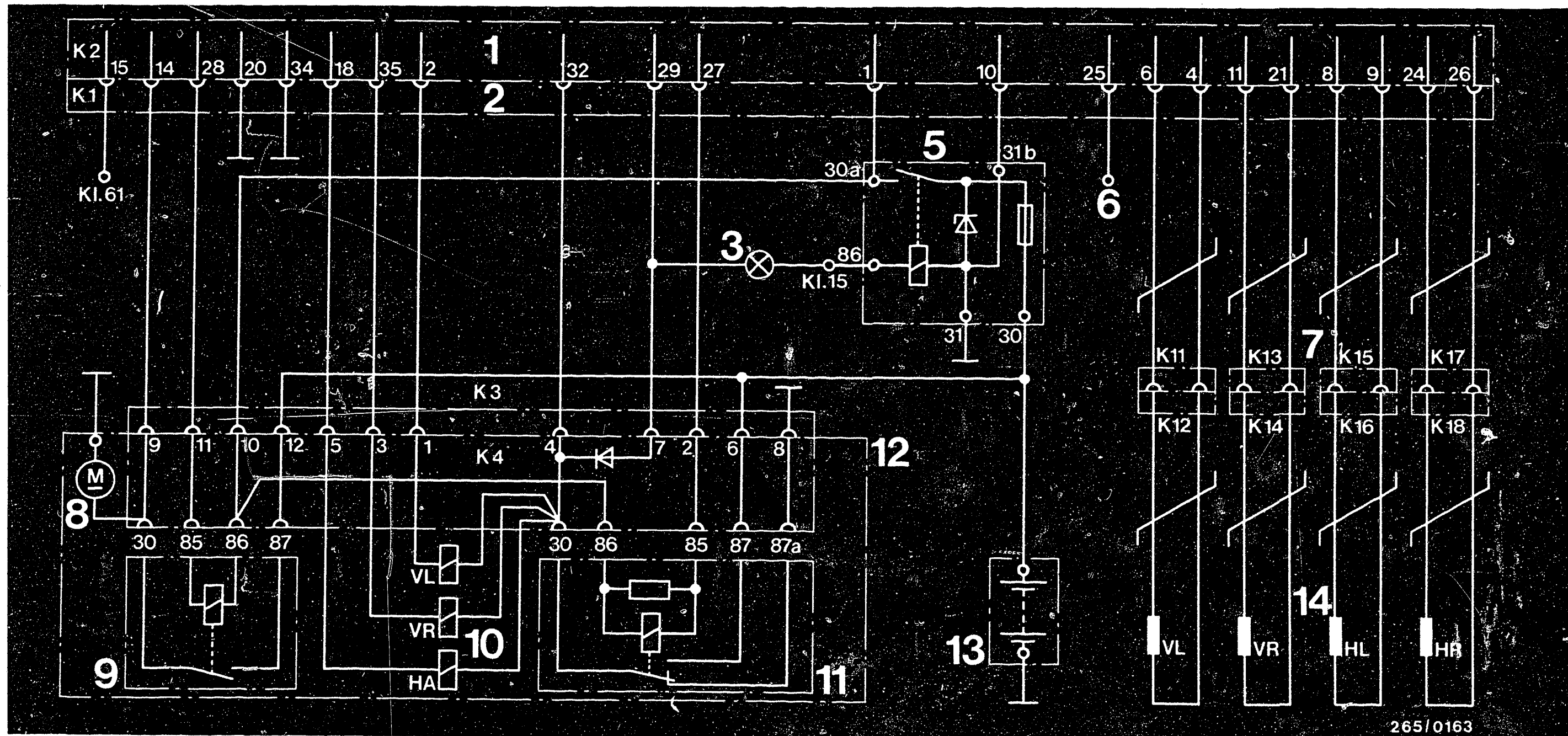


C17

Rapid diagnostic chart

BMW 320i / 323i





265/0163

- 1 = Electronic controller
- 2 = Multiple plug (35-pole)
- 3 = ABS signal light
- 5 = Overvoltage protection relay
- 6 = To the brake light switch (+)
- 7 = Lead connector
- 8 = Return pump motor

- 9 = Return-pump relay
- 10 = Solenoid valves
- 11 = Valve relay
- 12 = Hydraulic modulator
- 13 = Battery
- 14 = Wheel speed sensors

- VL = Left front
- VR = Right front
- HA = Rear axle
- HL = Left rear
- HR = Right rear
- K1 to K18 = ABS plug connections

4. ELECTRICAL CONNECTION DIAGRAM

C18

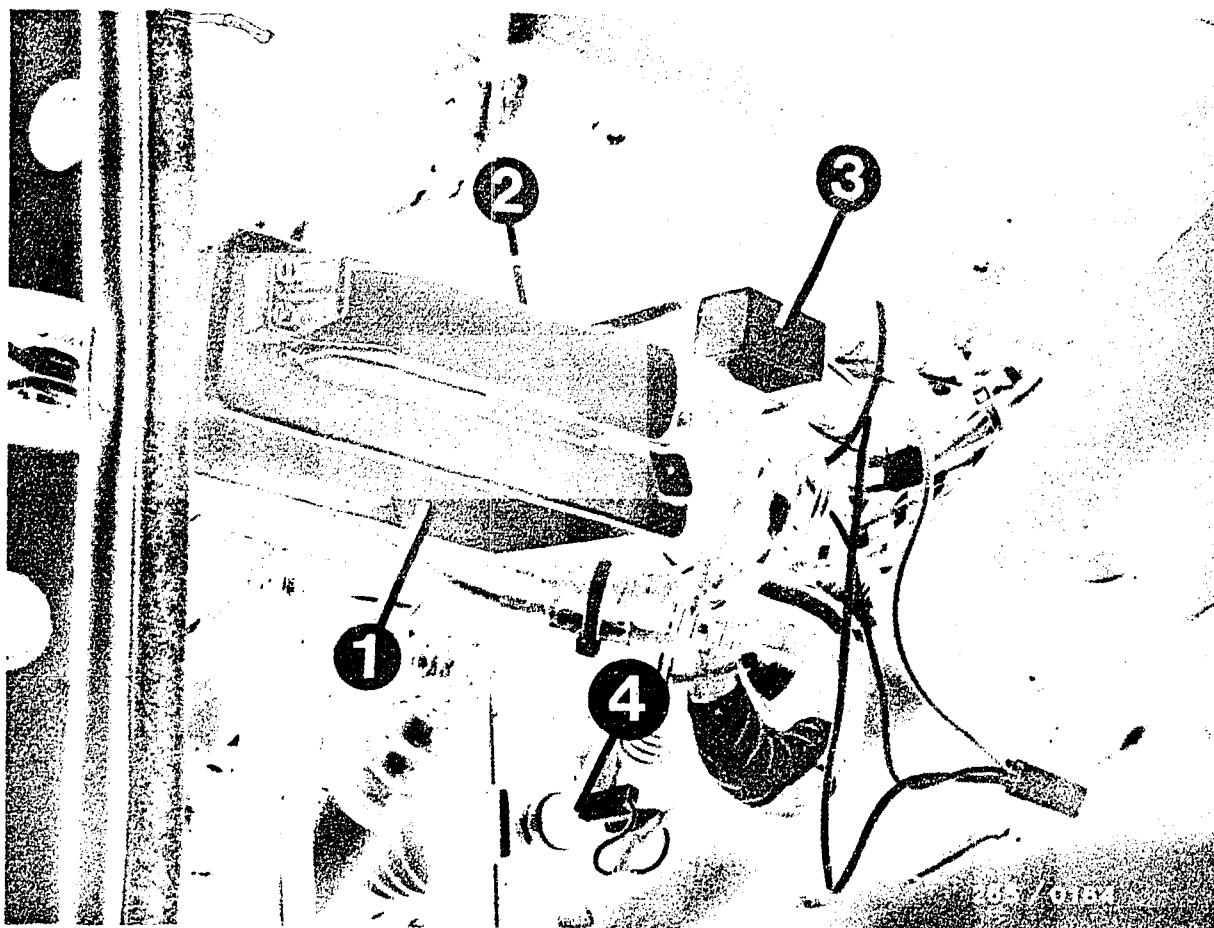
Electrical connection diagram
BMW 320i / 323i



C19

Electrical connection diagram
BMW 320i / 323i



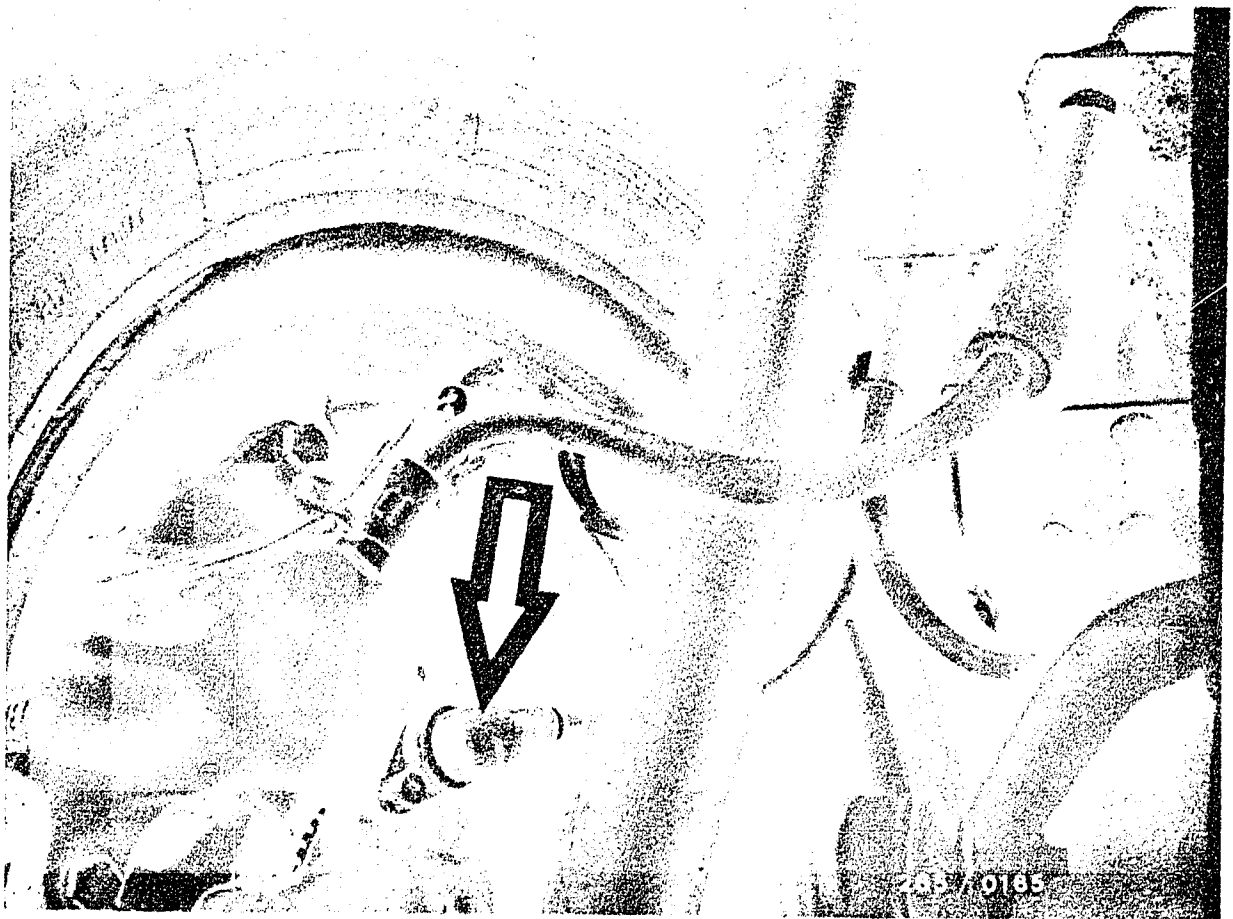


5. INSTALLATION POSITION OF THE COMPONENTS

Indications for installation position are always given looking in the direction of forward vehicle travel.

- 1 = Controller:
Behind the cover to the left of the steering column.
- 2 = Ground terminal for the ABS:
To the right of the controller.
- 3 = Overvoltage protection relay:
To the right of the controller.
- 4 = Brake light switch:
At the brake pedal.
- ABS signal light:
In the dashboard.





Arrow = Wheel speed sensor, left front,
 Make certain that the wheel speed sensors for
 the front wheels on the left and right are not
 exchanged for one another on installation.
 The air gap becomes too great and the signal
 too small!

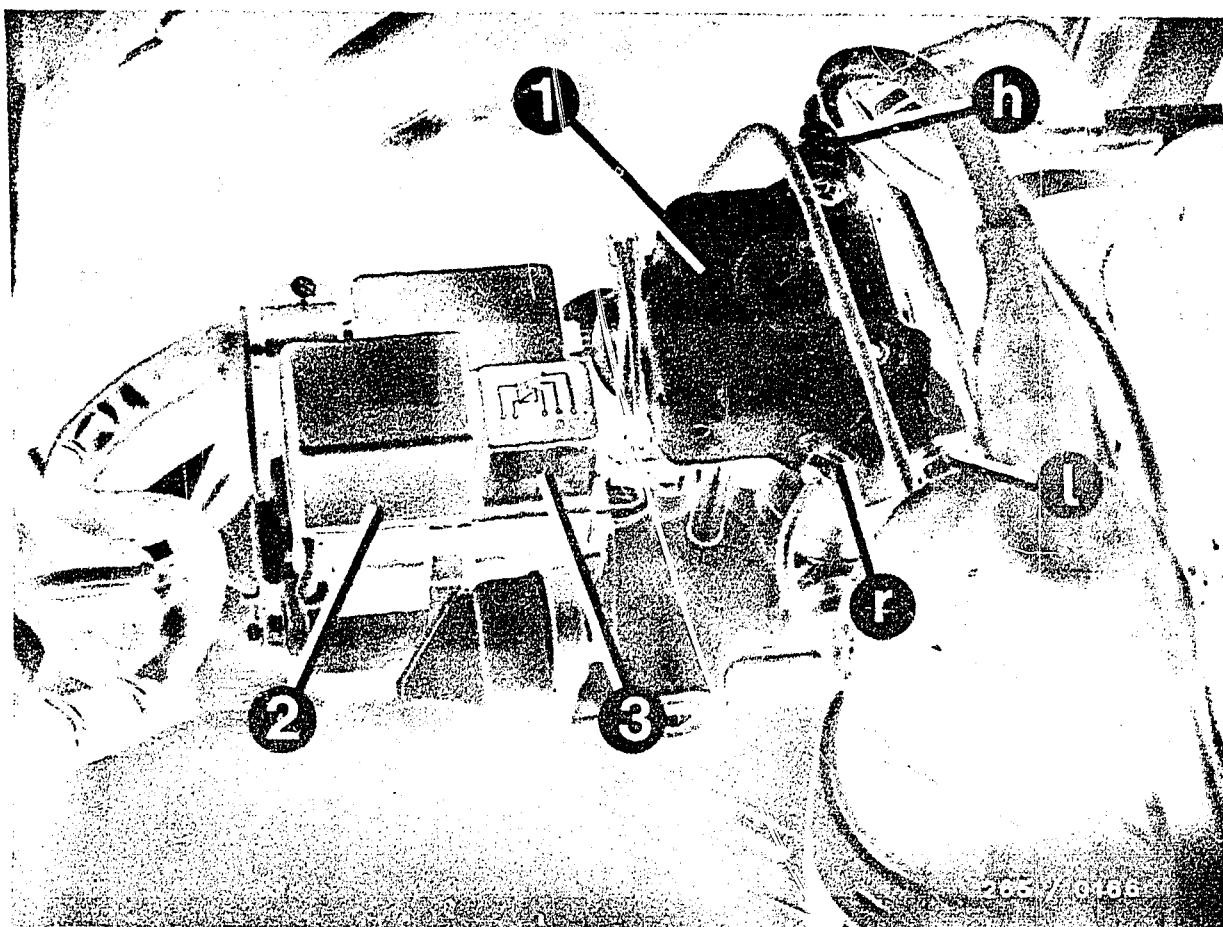
● Wheel speed sensors, front axle:

One each in the steering knuckles on the left and the
 right.

● Wheel speed sensors, rear axle:

One each on the left and right near the disc brake
 calipers.





1 = Hydraulic modulator:

In the engine compartment, behind the headlight on the left.

l = Brake line to the left front wheel brake cylinder

r = Brake line to the right front wheel brake cylinder

h = Brake line to the wheel brake cylinders on the rear wheels

2 = Return-pump relay

3 = Valve relay

The hydraulic modulator must not be repaired. It must be taken out and replaced as a complete unit only.

Exception: Replacement of relays.



6. TEST EQUIPMENT AND TOOLS

Name	Designation	Part number
<u>ABS-Tester</u> Use only retrofitted testers! Built after FD 352 or with identification "U2" on the nameplate	ETT 016.00	0 684 101 600
<u>Adapter cable</u> for connection of the overvoltage protection relay		1 684 460 120
<u>Brake test stand</u>	e.g. BPS 100 or BPS 101 or BPS 104 or BPS 105	0 680 012 .. 0 680 013 .. 0 680 018 .. 0 680 019 ..
<u>Filling and bleeding machine</u>		e.g. ATE Part No. 3.9302-1000.4 1)
<u>Bleeder tube fitting</u> to connect the filling and bleeding machine to the compensating reservoir of the main cylinder		ATE Part No. 3.9302-0702.2 1)
<u>Bleeder hose</u>		ATE Part No. 3.3590.2300.1 1)
<u>Additional hose</u>		ATE Part No. 3.9302.0704.2 1)
<u>Brake pedal winch</u>		ATE Part No. 3.9312.0100.4 1)

1) Obtain from: Alfred Teves GmbH
 Guerickestrasse 7
 D 6000 Frankfurt/Main



Name	Designation	Part number
<u>Pressure tester</u> Tester for low and high pressure testing of hydraulic brake systems		e.g. ATE Part No. 3.9305-0200.4 1)
<u>Double box wrench</u> open 9 x 11 mm		Hazet Part No. 612 2)
<u>Vessel</u> to catch the brake fluid, approx. 1 l <u>Brake fluid:</u> BMW-DOT 4 or ATE SL-DOT 4 or Veedol Disc Brake Fluid DOT 4 or Castrol Disc Brake Fluid DOT 4		
<u>Electric-tester</u> or <u>multi-tester</u> for trouble-shooting	ETE 014.00	0 684 101 400 Commercially available

6.1 Auxiliary material

Use only original brake lines from BMW!

Designation	Part number
Grease for wheel speed sensors	Molykote Longterm 2
Safety cap for brake lines	1 900 508 002 (100 pc.)
Protective caps for connections of brake lines to the hydraulic modulator	1 900 508 004 (100 pc.)

1) Obtain from: Alfred Teves GmbH, Guerickestrasse 7
D 6000 Frankfurt/Main

2) Firma Hazet, D 5630 Remscheid

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Test equipment and tools

BMW 320i / 323i



TABLE OF CONTENTS

Trouble-shooting instructions: LAI-502

BOSCH system : ABS

Make of vehicle : Lancia

Basic microcard : BMW-501

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1. SPECIAL FEATURES

These ABS instructions can be used for testing all Lancia Thema vehicles (as of 11.84). Further details can be found in the similar, detailed SIS instructions BMW-501 (6 series).

2. TEST SPECIFICATIONS

For reasons of safety, the ABS may only be tested using the ABS tester.

The rapid diagnosis chart contains all important test specifications as well as notes on testing and troubleshooting.

3. TEST CONDITIONS FOR TESTING WITH ABS TESTER

- The tester must have been converted to the latest technical status (identification "U2" on nameplate or as of FD 352).
- Check ground connections of return pump and overvoltage protection relay term. 31 for security and corrosion.
- Check hydraulic connections and joints on hydraulic modulator for leaks (visual examination).
- If the ABS warning lamp comes on occasionally while driving (e.g. after switching on electrical devices) and goes out again by itself, check battery and power supply (alternator, regulator and voltage drops).



- If the ABS warning lamp is constantly lit and does not go out, check the following points:
 - Is multiple plug correctly seated on control unit and is it latched in?
All plug contacts O.K.?
Spring contacts latched?
 - V-belt broken? (Alternator not supplying any voltage, charge indicator and ABS warning lamps on)
 - Voltage from alternator terminal 61?
Plug-in connector and lead to ABS control unit O.K.?
 - Check for loose contacts at wheel-speed sensors with program switch in position 10.
- For testing with the tester, switch on the ignition for all program switch positions (tester works on power supply from vehicle battery).
- Watch lamps 1 and 2 of tester for all program switch positions.

Caution:

Do not drive with the tester connected.
Whenever repairs have been carried out, repeat the entire test program.

General information on trouble-shooting

Check all leads for short circuit to ground and contact with positive leads, and also watch for worn spots and pinching.

- Connect ABS tester to control unit and ABS wiring harness.

Caution:

Disconnect and connect the control unit only with the ignition off.

The control unit is installed under the glove shelf.



4. RAPID DIAGNOSIS CHART FOR ABS TESTER

Switch on ignition for all program switch positions.

<u>Program switch position</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specifications (Reading)</u>	<u>Cause of trouble</u>
1 ... 24	Power supply for each test step	-----	Lamp 1 (green) must be lit for each test step.	<ul style="list-style-type: none"> ● Battery insufficiently charged. Repeat test step with engine running. ● Overvoltage protection relay defective. ● Check 4-pin plug (near control unit). ● High voltage drops at terminals (e.g. ground terminal). ● Open circuit in ground connection.
1	Valve relay off-position	-----	Lamp 1 (green) and lamp 3 (green) must be lit.	<ul style="list-style-type: none"> ● Open circuit or high contact resistance in leads (including ground lead) to valve relay. ● Valve relay defective.
2	Valve relay operation	-----	Lamp 1 (green) and lamp 3 (green) must be lit.	
3	Motor relay off-position	-----	Lamp 1 (green) and lamp 3 (green) must be lit.	<ul style="list-style-type: none"> ● Open circuit or high contact resistance in leads to motor relay. ● Motor relay defective. ● Check pump motor for continuity,
4	Motor relay operation	Press illuminated key	Lamp 1 (green) and lamp 3 (green) must be lit. Pump motor running.	

D4

Rapid diagnosis chart
Lancia Thema



D5

Rapid diagnosis chart
Lancia Thema



<u>Program switch position</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specifications (Reading)</u>	<u>Cause of trouble</u>
5	Overvoltage protection relay (built-in fuse and unidirectional-breakdown diode only)	Switch off ignition. Disconnect control unit. By means of adapter lead, connect overvoltage protection relay from vehicle in socket on tester. Connect identical new overvoltage protection relay in vehicle. Switch on ignition. Press illuminated key.	Lamp 1 (green) and lamp 3 (green) must be lit.	<ul style="list-style-type: none"> The overvoltage protection relay in the socket on the tester is defective.
6	Internal resistances of solenoid-operated valves in hydraulic modulator	Switch off ignition. Re-connect control unit. Switch on ignition. Press key FL Press key FR Press key RL Press key RR	Lamp 1 (green) must be lit. FL: 0.7 ... 1.7 Ω FR: 0.7 ... 1.7 Ω RL: 0.7 ... 1.7 Ω RR: 0.7 ... 1.7 Ω	<ul style="list-style-type: none"> Open circuit or high contact resistance in leads to the respective valve. Hydraulic modulator defective.
7	Ground connection to term. 10	Press illuminated key	Lamp 1 (green) must be lit. 80 ... 300 mV	<ul style="list-style-type: none"> Open circuit or high contact resistance in ground lead or ground terminal.
8	Ground connection to term. 34	Press illuminated key	Lamp 1 (green) must be lit. 10 ... 250 mV	
9	Ground connection to term. 20	Press illuminated key	Lamp 1 (green) must be lit. 10 ... 250 mV	

D6

Rapid diagnosis chart
Lancia Thema

D7

Rapid diagnosis chart
Lancia Thema


<u>Program switch setting</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specifications (Reading)</u>	<u>Cause of trouble</u>
10	Internal resistances of wheel-speed sensors	Press key FL Press key FR Press key RL Press key RR	Lamp 1 (green) must be constantly lit. FL : 0.6 ... 1.6 k Ω FR : 0.6 ... 1.6 k Ω RL : 0.6 ... 1.6 k Ω RR : 0.6 ... 1.6 k Ω	<ul style="list-style-type: none"> • Check for loose contacts: Move all leads at fastening points, at plug and at wheel-speed sensor, and watch reading. • Open circuit or high contact resistance in leads to the respective wheel-speed sensor. • Respective wheel-speed sensor defective.
11	Insulation resistances of wheel-speed sensors	Press key FL Press key FR Press key RL Press key RR	Lamp 1 (green) must be constantly lit. FL : 20 ... 999 k Ω FR : 20 ... 999 k Ω RL : 20 ... 999 k Ω RR : 20 ... 999 k Ω	<ul style="list-style-type: none"> • Check for insulation damage in leads to the respective wheel-speed sensor. • Respective wheel-speed sensor defective.
12	DC voltage on wheel-speed sensor leads	Press key FL Press key FR Press key RL Press key RR	FL : 000 ... 100 mV FR : 000 ... 100 mV RL : 000 ... 100 mV RR : 000 ... 100 mV	<ul style="list-style-type: none"> • Check leads to the respective wheel-speed sensor for contact (worn spot) with a positive lead. • Respective wheel-speed sensor defective.
13	Internal control unit supply voltage.	Press illuminated key	4.75 ... 5.25 V	<ul style="list-style-type: none"> • Control unit defective.



<u>Program switch position</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specifications (Reading)</u>	<u>Cause of trouble</u>
14	Diode in forward direction and ABS warning lamp		0.4 ... 1.5 V ABS warning lamp in vehicle must be lit	<ul style="list-style-type: none"> ● Open circuit or contact resistance in leads to diode and/or warning lamp. ● Warning lamp defective. ● Diode (hydraulic modulator) defective
15	Diode in reverse direction		2.5 ... 8.5 V	<ul style="list-style-type: none"> ● Check 4-pin plug (near control unit). ● Diode (hydraulic modulator) defective
16	Control unit BITE* triggering	Press illuminated key for 3 seconds	Warning lamp must go out after max. 1 second	<ul style="list-style-type: none"> ● Control unit defective.
17	Control unit, BITE* fault simulation	Press illuminated key for 3 seconds	Warning lamp must still be lit (flickering allowable).	<ul style="list-style-type: none"> ● Control unit defective.
18	Control unit, current for pressure holding	Press key FL, press illuminated key, press key FR, press illuminated key, press key RL, press illuminated key. press key RR, press illuminated key	FL : 1.9 ... 2.3 A FR : 1.9 ... 2.3 A RL : 1.9 ... 2.3 A RR : 1.9 ... 2.3 A	<ul style="list-style-type: none"> ● Control unit defective.
19	Control unit, current for pressure reduction	Press key FL, press illuminated key, press key FR, press illuminated key, press key RL, press illuminated key. Press key RR, press illuminated key.	FL : 4.5 ... 6.0 A FR : 4.5 ... 6.0 A RL : 4.5 ... 6.0 A RR : 4.5 ... 6.0 A	<ul style="list-style-type: none"> ● Control unit defective.
24	Voltage from stop-lamp switch	Press brake pedal	10 ... 15 V	<ul style="list-style-type: none"> ● Check 4-pin plug (near control unit). ● Lead to stop-lamp switch defective. ● Stop-lamp switch defective. ● Stop lamps defective.

* BITE = Built-in test equipment

D10

Rapid diagnosis chart
Lancia Thema



D11

Rapid diagnosis chart
Lancia Thema



A brake analyzer is required for program switch positions 20, 21, 22, and 23. Do not drive with the tester connected.
 Do not use a brake-pedal actuating device for setting the braking force. Program switch position 23 must come first.
Front axle.
 Drive front wheels of vehicle onto brake analyzer. Pull on handbrake.

<u>Program switch position</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specifications (Reading)</u>	<u>Cause of trouble</u>
23	Wheel-speed sensor signal and identity check	Press key FL, switch on left-hand brake roller.	<u>FL : 1.7 ... 19</u>	<ul style="list-style-type: none"> ● Wheel-speed sensors mixed up? ● Air gap too great. ● Respective wheel-speed sensor defective.
		Press key FR, switch off left-hand brake roller, switch on right-hand brake roller.	<u>FR : 1.7 ... 19</u>	
20	Hydraulic modulator pressure reduction and identity check	Press key FR. Switch on right-hand brake roller. Press brake pedal and hold constant at 2000 N. Press illuminated key.	<u>FR : less than 1100N</u>	<ul style="list-style-type: none"> ● End reading may change by max. 200 N in 3 sec. ● Brake lines mixed up? ● Conventional braking system O.K.? ● Hydraulic modulator defective. <p>Note: Replace hydraulic modulator only as a complete unit. Repairing is not allowed. Danger!</p>
		Press key FL. Switch off right-hand brake roller. Switch on left-hand brake roller. Press brake pedal and hold constant at 2000 N. Press illuminated key.	<u>FL : less than 1100N</u>	
21	Hydraulic modulator pressure buildup	Press key FL. Switch on both brake rollers. Press brake pedal and hold constant at 2000 N. Allowable difference between both wheels max. 500 N. Press illuminated key.	Left-hand brake analyzer reading moves to an intermediate value and rises again to <u>FL: 600 ... 1500 N</u>	

D12

Rapid diagnosis chart

Lancia Thema



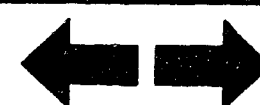
D13

Rapid diagnosis chart

Lancia Thema



<u>Program switch position</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specifications (Reading)</u>	<u>Cause of trouble</u>
21	Hydraulic modulator pressure buildup	Press key FR. Switch on both brake rollers. Press brake pedal and hold constant at 2000 N. Press illuminated key	Right-hand brake analyzer reading moves to an intermediate value and rises again to <u>FR : 600 ... 1500 N</u>	<ul style="list-style-type: none"> ● End reading may change by max. 200 N in 3 secs. ● Brake lines mixed up? ● Conventional braking system O.K.? ● Hydraulic modulator defective. <p>Note: Replace hydraulic modulator only as a complete unit. Repairing is not allowed. Danger!</p>
22	Hydraulic modulator pump delivery, brake circuit 1	Switch on brake rollers. Read off inherent friction value on right. Press key FR. Press brake pedal and hold constant at 2000 N. Press illuminated key.	After an intermediate value on the right, return pump switches on briefly. Reading on right must drop below inherent friction value plus <u>200 N.</u> Press illuminated key until reading rises again to 2000 N.	<ul style="list-style-type: none"> ● Hydraulic modulator defective. <p>Note: Replace hydraulic modulator only as a complete unit. Repairing is not allowed. Danger!</p>
	Hydraulic modulator pump delivery, brake circuit 2	Switch on brake rollers. Read off inherent friction value on left. Press key FL. Press brake pedal and hold constant at 2000 N. Press illuminated key.	After an intermediate value on the left, return pump switches on briefly. Reading on left must drop below inherent friction value plus <u>200 N.</u> Press illuminated key until reading rises again to 2000 N.	



Rear axle:

Drive rear wheels of vehicle onto brake analyzer.

Release hand brake.

In vehicles with automatic transmission, selector lever to position "N".

Program switch position	Testing of	Additional operation	Test specifications (Reading)	Cause of trouble
23	Wheel-speed sensor signal and identity check	Press key RL, switch on left-hand brake roller. Press key RR, switch off left-hand brake roller, switch on right-hand brake roller.	RL: 1.7 ... 19 RR: 1.7 ... 19	<ul style="list-style-type: none"> • Wheel-speed sensors mixed up? • Air gap too great. • Respective wheel-speed sensor defective.
20	Hydraulic modulator pressure reduction and identity check	Press key RR. Switch on right-hand brake roller. Press brake pedal and hold constant at 1500 N. Press illuminated key. Press key RL. Switch off right-hand brake roller. Switch on left-hand brake roller. Press brake pedal and hold constant at 1500 N. Press illuminated key.	RR: less than 800 N RL: less than 800 N	<ul style="list-style-type: none"> • End reading may change by max. 200 N in 3 sec. • Brake lines mixed up? • Conventional braking system O.K.? • Hydraulic modulator defective. <p><u>Note:</u> Replace hydraulic modulator only as a complete unit. Repairing is not allowed. Danger!</p>
21	Hydraulic modulator pressure buildup	Press key RL. Switch on both brake rollers. Press brake pedal and hold constant at 1500 N. Allowable difference between both wheels max. 400 N. Press illuminated key. Press key RR. Switch on both brake rollers. Press brake pedal and hold constant at 1500 N. Press illuminated key.	Left-hand brake analyzer reading moves to an intermediate value and rises again to RL: 500 ... 1400 N Right-hand brake analyzer reading moves to an intermediate value and rises again to RR: 500 ... 1400 N	

Finally, conduct a road test.

With the engine running, the indicator lamp must go out. Drive at at least 30 km/h.

The indicator lamp must not come on again.

D 16

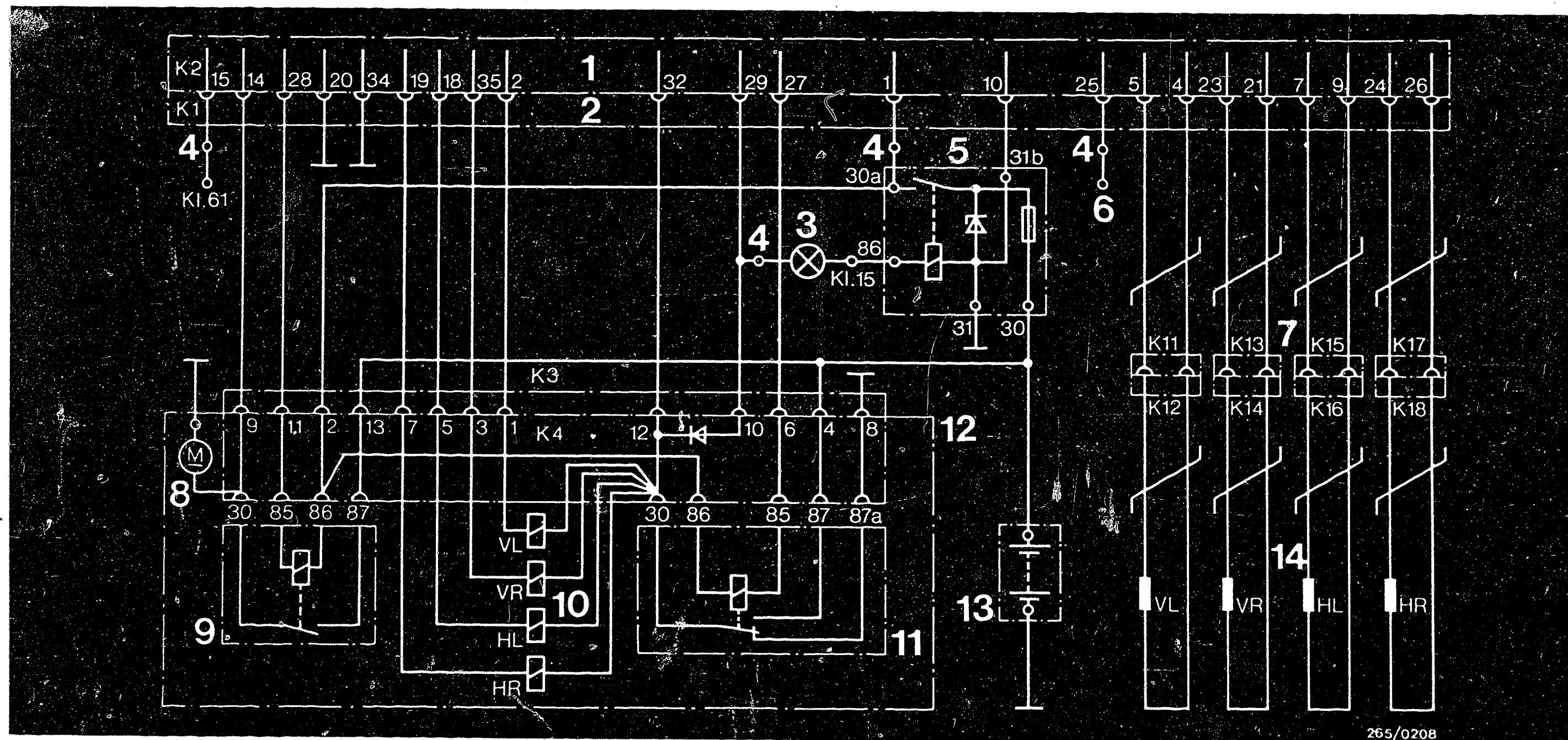
Rapid diagnosis chart
Lancia Thema



D 17

Rapid diagnosis chart
Lancia Thema





265/0208

- 1 = Electronic control unit
- 2 = Multiple plug (35-pin)
- 3 = ABS warning lamp
- 4 = 4-pin plug near control unit
- 5 = Overvoltage protection relay
- 6 = To stop-lamp switch (+)
- 7 = Cable connector

- 8 = Return-pump motor
- 9 = Motor relay
- 10 = Solenoid-op. valves
- 11 = Valve relay
- 12 = Hydraulic modulator
- 13 = Battery
- 14 = Wheel-speed sensor

- VL = FL = front left
- VR = FR = front right
- HA = RA = rear axle
- HL = RL = rear left
- HR = RR = rear right
- K1 to K18 = ABS plug connectors

5. ELECTRICAL TERMINAL DIAGRAM

D18

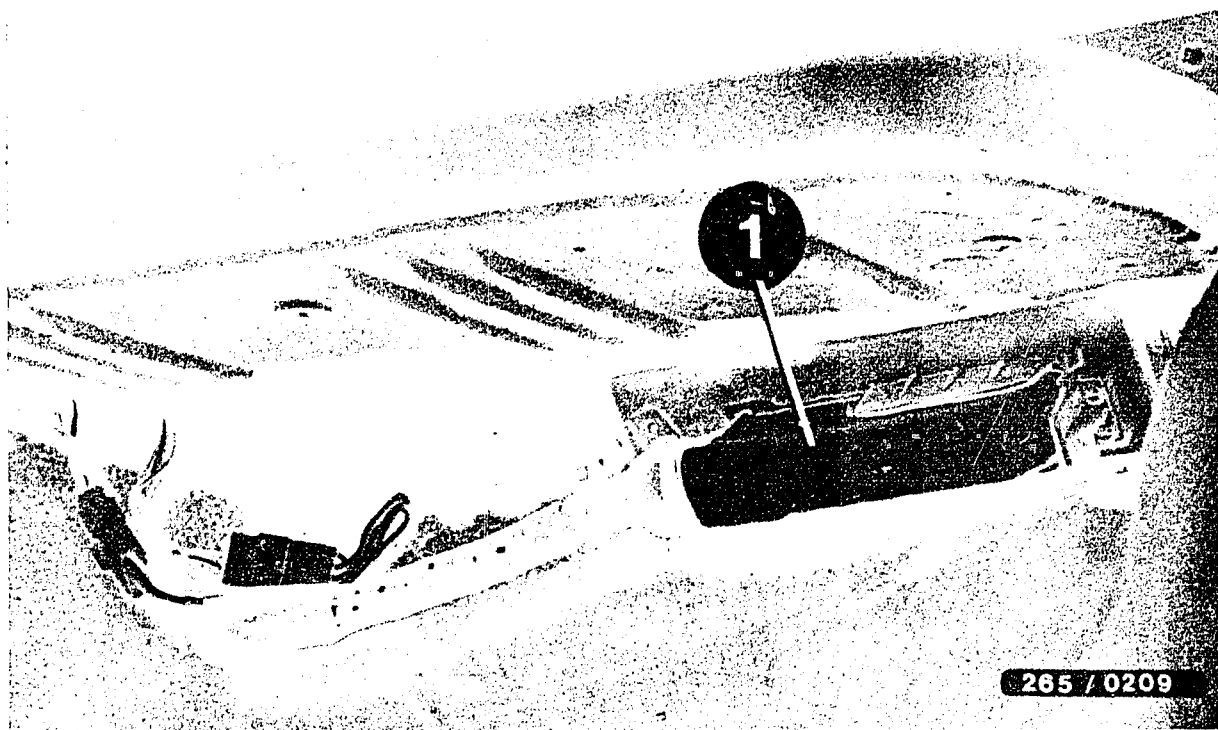
Electrical terminal diagram
Lancia Thema



D19

Electrical terminal diagram
Lancia Thema





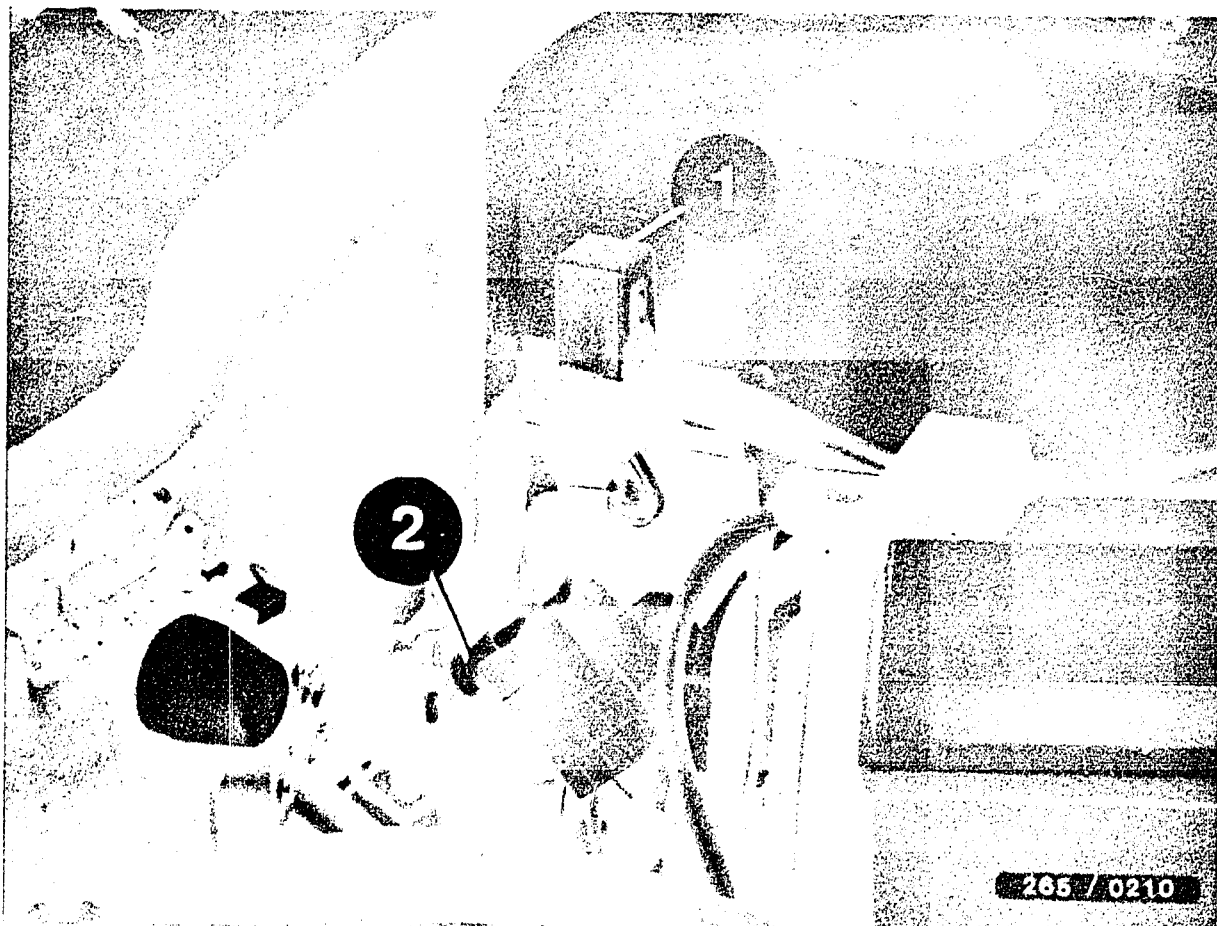
1 = ABS control unit

6. INSTALLATION POSITION OF COMPONENTS

The indications "right" and "left" apply always as viewed in the forward direction of travel.

- Control unit: Below glove shelf.
- Hydraulic modulator: In engine compartment, front left, in front of battery.
- Ground terminal: On battery B -
- ABS warning lamp: In instrument panel.





- 1 = Overvoltage protection relay
 2 = Wheel-speed sensor plug connector

● Overvoltage protection relay:

In engine compartment on left, near spring strut.

● Front-axle wheel-speed sensors:

One each on left and right in steering knuckles.

Corresponding plug connectors:

In engine compartment on left, below overvoltage protection relay and on right on spring strut crown.

● Rear-axle wheel-speed sensors:

One each on left and right behind brake disks.

Corresponding plug connectors:

On left and right in luggage-compartment recesses.



7. TEST EQUIPMENT AND TOOLS

Description	Designation	Part No.
<u>ABS tester</u> Use only converted tester. Identification "U2" on nameplate or as of FD 352	ETT 016.00	0 684 101 600
<u>Brake analyzer</u>	e.g. BPS 100 or BPS 101 or BPS 104 or BPS 105	0 680 012 .. 0 680 013 .. 0 680 018 .. 0 680 019 ..
<u>Filling and discharging device</u>		e.g. ATE Part No. 3.9302-1000.4 ¹⁾
<u>Bleeder fitting</u> For connection of filling and discharging device to master cylinder fluid reservoir		ATE Part No. 3.9302.0702.2 ¹⁾
<u>Bleeder hose</u>		ATE Part No. 3.3590.2300.1 ¹⁾
<u>Auxiliary hose</u>		ATE Part No. 3.9302.0704.2 ¹⁾
Brake-pedal actuating device		ATE Part No. 3.9312.0100.4 ¹⁾

1) = obtainable from Alfred Teves GmbH, Guerickestraße 7
600 Frankfurt (Main)



Description	Designation	Part No.
Pressure tester Tester for low- and high-pressure testing of hydraulic brake systems		e.g. ATE Part No. 3.9305-0200.4 1)
Double-end box wrench open 9 x 11 mm		Hazet Part No. 612 2)
Vessel for collecting the brake fluid approx. 1 l		
Brake fluid	Dutela DOT 4	
Electrics tester or Multimeter for trouble- shooting	ETE 014.00	0 684 101 400 commercially available

1) = obtainable from: Alfred Teves GmbH
Guerickestr. 7
6000 Frankfurt (Main)

2) Firma Hazet
5630 Remscheid



7.1 Additional equipment

Use only Lancia genuine brake lines.

<u>Description</u>	<u>Part No.</u>
Grease for wheel-speed sensors	Molykote Longterm 2
Protective caps for brake lines	Bosch Part No. 1 900 508 002 (100 pieces)
Protective caps for brake line connections on hydraulic modulator	1 900 508 004 (100 pieces)

